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British Journal of Anæsthesia

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British Journal of Anæsthesia

VOL. II. NO. 1. JULY, 1924.

JOSEPH, 1st BARON LISTER, PAUL BERT, AND THE DOSIMETRIC METHOD OF ADMINISTERING CHLOROFORM.

By DUDLEY WILMOT BUXTON, M.D., B.S., M.R.C.P.,
Consulting Anæsthetist to University College Hospital.

IN 1827 was born at Upton, in Essex, Joseph Lister, the distinguished son of a distinguished father. The latter, Joseph Jackson Lister, F.R.S., undertook researches into the science of optics, especially as regards improvements in the construction of lenses, perfected the compound microscope and opened the way to great advances into our knowledge of the realms of the unseen. Joseph Lister, after passing through Quaker schools at Hitchin and Tottenham, entered University College, London, became an undergraduate of London, graduating B.A. in 1847. He then entered as a medical student at University College Hospital, took the M.B. degree in 1852, and the same year became a Fellow of the Royal College of Surgeons of England. Thus, as has been pointed out, Lister was a contemporary student with Joseph Clover, and was present at the first public demonstration in England of the use of ether as an anæsthetic given at the University College Hospital, when Robert Listor amputated a limb.

If this experience gave him the initial bias towards the study of anæsthesia, a study undertaken years afterwards and pregnant of much valuable thought, it was another experience encountered in this hospital which turned Lister's mind towards the study of septic infection and its prevention. The opprobium of hospitals in those days was spreading gangrene, and an outbreak of this fell disease occurred when

Lister was a house surgeon. A serious railway accident flooded the surgical wards with its victims. Overcrowding and the unsatisfactory state of hospital wards and surgical methods in general, gave young Lister, then a house surgeon, many an object lesson which he was not slow to assimilate. Here the father's work on the microscope stood the son in good stead.

Lister's life work in the more immediate demesne of surgery and pathology, however, is not our present subject. The scene of his life shifted, at the instance of Syme, whom he accompanied from London to Edinburgh; afterwards to Glasgow, where he occupied the Chair of Surgery. Later, once more in London, Lister's energies never flagged, and among the long procession of subjects with which they grappled and enlightened was that of Anæsthetics. The first pronouncement on this matter was in 1861,[1] when he was still greatly under the influence of Syme and the Scotch school of thought, although, as was ever the case with Lister, he was prepared to hear and discuss the views of those who differed from him.

Paul Bert, the second of those whose work on anæsthetics it is proposed to consider in this paper, was born at Auxerre (Yonne) October 17th, 1833. Working at the Ecole Polytechnique of Paris, Bert studied first engineering, then Law, but coming under the influence of the master mind of Gratiolet he forsook these subjects and devoted himself to zoology and physiology. To Claude Bernard's influence we can trace much of the inspiration of Bert's work, and few men traversed wider and more diverse lines of research than did Paul Bert.[2] His classical study, "La Pression Barométrique," which laid the foundation of much of our present knowledge of this subject, was published in 1878, but we are concerned with later investigations, namely, those into the action of poisons leading up to the study of narcotics and anæsthetics. These were published between 1880 and 1883. Bert was familiar with the

1. See "Collected Papers of Joseph Baron Lister," vol. i, p. 135.

2. The salient facts concerning Paul Bert's scientific work will be found in "L'œuvre scientifique de Paul Bert," par le doctor E. Berillon, Paris, 1887. Bert's papers appeared throughout the "Comptes rendus de l'Academie des Sciences," 1881—1883, and in other scientific proceedings issued about this period.

experiments of Flourens, who, as he points out, undertook the study of chloroform before Simpson, although he did not recommend its use clinically, since he regarded it as too dangerous an agent for this purpose. Probably, however, he owed more to Claude Bernard than to Flourens, since the former carried the knowledge of narcotics further than had the latter and attacked the study in a wider horizon.

The name of Bert is perhaps more familiar to us in connexion with the subject of nitrous oxide, an agent which he extolled and constantly recommended in its intensive use in major surgery, a suggestion which to-day has been revived and, if one may be permitted the term, "boomed." For the moment, however, let us consider his chloroform work since it is this line of study which brings him into the ambit of Lister's research.

Although chloroform came into general use soon after Simpson's pronouncement in its favour in 1847, little accurate clinical study of the agent had been undertaken, if we except the work of Snow, and Snow was like one crying in the wilderness of loose talk and senseless prejudice. The enquiry into the action of chloroform, even the justifiability of its use in surgery, have ever been a cockpit in which the antagonists have reviled each other often in fluent Doric and have dragged science and logic through the mud of personalities and the *idée fixe*. The clergy and other good persons averred that as the Almighty had imposed the penalty of pain in parturition, to use chloroform to assuage the birth-pang was an impious attempt to contravene the will of the Omnipotent.

Great Britain was split into two camps, Simpson and Syme engendered faith in what has been somewhat faultily called the "slapdash" system, while the upholders of the contrary view, led by Snow, taught that chloroform, as is the case with all drugs, must and does exert its action according to the dose given to the patient. The record of Edinburgh, even if it is favoured by the substitution of a Procurator Fiscal for our own Coroner, reveals that the Scotch method of unstinted doses but high dilutions has much to be said in its favour However, it has been often pointed out that, even if when such simple rules as were laid down by Syme are carried out faithfully and a due dilution of the vapour is obtained, yet neither Simpson nor

Syme nor any of their immediate followers either knew what was the required dilution nor made any attempt to ascertain it. "Whether it is five drachms or five hundred drachms does not matter." The deaths which were reported in England and on the Continent enforced the lesson that the drug could and did prove dangerous. Scotland declared this was because the correct method was not practised; Snow, and later Bert, took the ground that whatever method was adopted must be dangerous unless the properties of the drug used were known and the accurate dosage understood. Lister, entering the lists for the Scotch method of his father-in-law, Syme, soon recognized the truth of this contention. He attempted—with what success the sequel will show—to reconcile the two diverse lines of thought by studying the action of chloroform, both clinically and by way of experiment, and so hoped to prove that the simpler method of Syme really depended upon a true, even if unappreciated, conception of chloroform's action.

But two factors in the question at this time existed which were not understood: the mode of death; the severity of the operations.

There can, I think, be little doubt that Lister, with his wider outlook on surgery and the increased severity of the operations he was called upon to undertake, became more ready to accept a less biassed view of the chloroform question than did Syme. Certain it is that we can trace by a careful study of his three papers on anæsthetics that he gradually modified his views, and finally accepted much that he had disagreed with in earlier years.

Syme's teaching, which has been more recently stressed by the late Colonel Lawrie, and expressed *con robusto* in the Hyderabad Chloroform Report, was that chloroform kills and kills only through respiratory failure. Snow and Bernard proved experimentally that chloroform will cause respiratory collapse and death by prolonged inhalation of moderately strong percentages of that anæsthetic in air, but can cause death rapidly by giving stronger vapours. In this last case the heart failure is primary and not due to gradual respiratory collapse. Simpson admitted the possibility of heart failure due to chloroform, but regarded it as a rare occurrence, and preferred to believe that cardiac collapse in most cases arose rather from

fear, shock or other cause than from the result of chloroform. Lister, it would appear, at first leant to Syme's teaching, but later accepted Simpson's broader view, and finally admitted that under certain circumstances death might arise when it could not be accounted for by respiratory collapse. He, however, held strongly that chloroform, so far from causing shock, actually protected the patient from the depressing effects of a surgical operation.

Bert, whose experiments we must advance against the mere *a priori* reasoning of his opponents, admitted two modes of chloroform fatalities—one due to respiratory collapse, the other to primary heart failure. As we shall see later, these experiments impressed Lister, and induced him to make experiments which appear to have satisfied his mind that Bert's work valuable as he admitted it to be, was not convincing. Dastre, the physiologist, writing about this time, put the matter in a forcible way. Arrest of respiration, he asserted, is not an accident, that is, it must ensue if choloroform is given continuously and of a certain strength; poisoning by chloroform, that is, arrest of the heart, is an accident, and not a necessary chloroform effect. In other words, respiratory arrest is preventable and the patient can in most cases be revived; heart failure means protoplasm poisoning, and culminates in death.

However, the controversy now assumed a wider and more precise outlook, and was run on intelligent lines. The teaching of Snow, once again examined, was recognized as indicating that the correct dosage of chloroform was the key to the problem. Bert and less fully Lister subscribed to these views, and out of the welter emerged THE DOSIMETRIC SYSTEM of giving CHLOROFORM.

Taking the narrative of the experiments in chronological order, we come first to Snow's work, which was considered in an earlier paper.

1. Snow proved that (experiments on the lower animals) percentages of chloroform vapour in air less than 0.9 per cent. did not produce anæsthesia. Those from 0.96 per cent. to 1.5 per cent. produce anæsthesia. Percentages from 1.7 per cent. to 2.9 per cent. cause interference with respiration. Snow estimated that double the anæsthetic dose of chloroform

vapour in air was the lethal dose, and Bert's experiments, undertaken much later, brought him to the same conclusion. In 1881 Bert presented a paper to the Société de Biologie, in which he discussed the dangers of narcotic vapours, describing his experiments undertaken to show that these agents were safe if given in certain percentages, lethal if those percentages were exceeded. He declared " En d'autres termes le chloroforme n'agit pas par la quantité qu'on respire, mais par la proportion qui s'en trouve dans l'air inspiré."

2. We will now given Bert's conclusions (experiments on animals). Percentages of chloroform below 2 per cent. produce deep sleep, but not anæsthesia; 2 per cent. cause true anæsthesia, and higher percentages killed. He found, further, that a continuous inhalation of percentages below that required to induce insensibility if prolonged led to the death of the inhaling animals. The temperature gradually fell and death ensued, being apparently due to interference with metabolism, and this before the central nervous system had come under the influence of the drug.

Although a number of narcotics were examined at this time by Bert, and his results published, these results are not of sufficient interest in the present connexion to call for detailed notice.

With regard to higher percentages, Bert found that those competent to produce loss of sensibility if inhaled in undiminished strength for a long time always killed. Animals, although apparently physically equivalent, revealed individual susceptibility to chloroform. The heart beat persisted after respiratory failure. Chloroform was not found in the urine.

The next step was to ascertain whether it was possible to produce anæsthesia with safety and continue the action of the chloroform without killing the animal. After some further experiments, Bert found that he could induce anæsthesia with a vapour of 2.4 per cent. (12 à 100)[1] for induction and then could maintain unconsciousness for several hours by changing the strength of vapour inhaled to 1.6 per cent. (8 à 100). In these circumstances no failure of respiration or circulation

1. In this paper the French notation has been changed into the equivalent terms of the English scale.

occurred. Thus Bert elaborated his method of *mélanges titrés*. The period between the onset of unconsciousness and that when respiration began to be affected was named by him *la zone maniable* or "workable zone."

The next step was to test the truth of the theory upon human beings, and this was done, volumetric vapours in Dr. Saint-Martin's gas-containers being employed. The results were published in 1884. The vapour strength of 1.6 per cent. (8 à 100) was employed, and continuous inhalation adopted. Surgical operations were performed with complete success, while after effects, such as sickness, headache and so on, were stated to be slight or absent. Bert's assertions that provided the strength of the vapours used, up to 1.6 per cent. (8 à 100) for induction and lower for maintenance, could be safely used for a *continuous* administration of chloroform in surgical operations were not allowed to pass unchallenged. Various French surgeons attacked both Bert and his method with vigour and even animus. M. Gosselin objected to the cumbersomeness of the apparatus which, he averred, must restrict its use to hospitals since it could not be transported from place to place. This drawback was promptly met by the obvious remedy, that of making a smaller apparatus running on a wheeled trolley. The ingenuity of Dr. Saint-Martin once more was called into play. M. Gosselin, however, defended the compress method of Simpson, naively stating that, provided the induction was not pushed too rapidly and M. Sédillot's "simple" rules were sedulously adhered to no fatality could occur. It will be noted that he thus admitted at least two loopholes for error, so the system he extolled could hardly be regarded as "fool proof," depending as it does upon the alertness of the administrator, who may be tired, careless or nervous. Bert's reply was to stigmatize the common methods in vogue as "empirical." He pooh-poohed the plea of idiosyncracy advanced to explain chloroform deaths which he asserted were really due to the inequalities and irregularities of the administration, all inherent in the system employed, and the total absence of any exact knowledge of the strength of the vapour presented to the patient. M. Richet, who opposed Bert's tenets more trenchantly than kindly, insisted that his experience of "after effects" accruing as the result of the

older methods were far less gloomy than those described by Bert, but so far as one can gather, M. Richet's experiences were only slight, and in the main hearsay. As to the safety of the cruder method, Richet quoted a wide range of statistics which do not appear to strengthen his contention since the varied results of different clinics point rather to the conclusion that while in all the method was dangerous, in some greater skill and attention to detail produced favourable results. While extolling Clover's method, a method with which Bert curiously enough was unacquainted, he quotes Clover's published records of his fatalities. It will be remembered that these were due, so Clover believed, not to a failure of his dosimetric system, but to the error made in introducing too much chloroform into the bag of his apparatus. Indeed, Clover's record exemplifies the safety and danger of the personal equation. He used largely the lint, covered by a towel system, admittedly open to grave chances of mishaps, and did so without a death, but met with several fatalities when using his dosimetric bag.

Bert's reply to Richet is a model of calm scientific criticism. He points out that while he pins his faith to no special apparatus, he does not assert that the method he advocates is perfect, he yet claims that his work is a step forward towards the consummation of an ideal system and a possibly perfect method. His contention was that the danger of chloroform lies not in the actual bulk of the drug introduced into the tissues of the patient but in the strength of the vapour which is allowed to be inhaled. If this is safeguarded the chloroform problem, he believed, was solved. As to the statistics quoted by Richet, he questioned their value, as M. Duret had shown that probably not a third of the actual deaths were ever reported. Of course, the actual bulk of chloroform introduced into the tissues was ultimately of importance, as beyond a certain point the chloroform, acting as it does upon the glandular tissues of the body, leads to inhibition of metabolism, fall of temperature and ultimately to death. This, however, is chloroform poisoning not chloroform dosage. These results are shown in the following table. The animal used was a dog :—

Percentages.	State	Died.	Rectal temperature.
0.8 (4 à 100)	sensible	Alive after 9 hrs. 30 mins.	To 35° C.
1.2 (6 à 100)	„	Died in 6 to 7 hrs.	31° to 32°
1.6 (.8 à 100)	insensible but easily aroused.	—	—
2.0 (10 à 100)	insensible in a few minutes.	Died in 2 hrs. to 2 hrs. 5 mins. no convulsion.	—
2.5 (12.5 à 100)	„	Died in 1 hr. to 1 hr. 25 mins.	—
2.8 to 3.2	„	Died in 40 mins.	35° to 33°
3.6 to 4	„	Died in 30 mins.	35° to 34°
6	„	Died in 3 mins.	39° to 37°

Bert, led possibly by the strictures made upon the gas container method, experimented in other directions with the view of obtaining a method of *mélanges titrés*, and was ably assisted by a number of workers who adopted his view with enthusiasm. We may mention Gréhaut and Quainquand's alcohol and chloroform mixture, and that of chloroform and oil, but Bert found that evaporation was unreliable, and, further, was not under the control of the administrator. Dr. Dubois, who with M.M. Labbé and Péan had rendered Bert such yeoman service, constructed his machine, which remains one of the best dosimetric apparatus available. However, it has not received much attention in this country, probably because of its size and possibly because mechanical contrivances do not appeal to busy practitioners. Its use enabled Bert to continue his researches and confirmed him in his beliefs. The drop method of Dr. Peyraud, if tedious, was spoken well of by Bert. It depended upon the volatilisation of one drop of chloroform every seven minutes. The length of time required to produce anæsthesia is a question of arithmetic, and may be left at that. Little has been said about Bert's views as regards heart paralysis under chloroform anæsthesia, but his statements are very definite and may be summarised as follows:—

(1) Weak vapours drowse but do not produce anæsthesia, but if given continuously kill by failure of the body's metabolism.

(2) Vapours within his *zone maniable* cause anæsthesia, but

unless given continuously for some hours do not interfere with respiration or circulation.

(3) Stronger vapours produce anæsthesia rapidly, and soon lead to respiratory paralysis.

(4) Very strong vapours kill at once by paralysing the heart.

It is outside the scope of this paper to discuss the extensive and valuable work which Bert carried out with nitrous oxide gas. He believed that that anæsthetic was the ideal one for general surgery, and he laboured more or less successfully to provide a safe system of employing it. He comments strongly upon the intermittent method then adopted in the United States of America, which he stigmatises as atrocious. By mixing oxygen with the gas Bert achieved a *mélange titré* for this anæsthetic, and used it both under increased atmospheric and normal pressure. Much that is valuable can be culled from his Leçons sur la Respiration, especially the experiments in which he showed how profoundly the vagus and naso-oral nerves come into play in poisoning by anæsthetics. Indeed, much of the inspiration of Brown-Séquard's work on this point may well have come from Bert's classical lessons.

Here we must part with this great pioneer in the dark ways of anæsthesia. Bert, the close friend of Gambetta, turned aside from science to the arid regions of politics. In 1886 he was appointed Resident-General in Annam and Tonkin, and died from dysentery at Hanoi in the November of that year.

Lister's three papers which appeared in Holmes' System of Surgery were dated 1861, 1870 and 1882. They express a gradual widening of his views as regards chloroform and its action. The comparatively few experiments he made upon this subject were made to contest the views of Snow and his school, and this lessened their value since they carried our knowledge of the subject no further.

At first Lister accepted the compress method as safe, simple and sufficient; later he was led to believe that it was not an ideal plan. He wrote: "If for the fitful mode of administration by the folded towel, with atmospheres perpetually oscillating between the needlessly strong and the uselessly weak, we can substitute a method which will give a uniform

and at the same time a mild anæsthetic air, we may anticipate beneficial results." Thus he accepts a hypothetical dosimetric method, although he expressed himself as dubious about the absolute safety of Bert's *mélanges titrés* system. He further recognised and applauded Bert's adoption of a continuous in place of the previous vogue of intermittent chloroformisation.

Lister's criticism of Snow's views and practice, as, indeed, that of his criticism of Bert's experiments, is open to cavil, since it is clear that Snow's words do not lend themselves to the interpretation set upon them by Lister. In no place did Snow state that most of the deaths under chloroform were due to heart disease or indeed to heart failure. His views that circulatory collapse is the necessary result of an excessive percentage strength of chloroform, the value of which is double that competent to induce anæsthesia, that is, 2 and 4 per cent., have been abundantly corroborated by subsequent experiments. Snow contended that deaths from heart failure were the exception and could only arise from using an over-strong vapour, a contingency most likely to happen when a compress was used. Lister's criticism, elicited by the "Glasgow Anæsthetics Report of the British Medical Association," pithily describes his position in the quotation. "I have contended," he writes, "that if the breathing is carefully watched the objections referred to (interference with respiration) are removed as soon as they occur, due care being taken to avoid pushing the agent beyond what is needful to produce its anæsthetic and relaxing effects, the chloroform being well mixed with air by means of a folded towel held close to the face, all fear of primary failure of the heart may be dismissed from the mind." Unhappily the accomplishment of these desiderata, even in the hands of the expert, is not always possible, and in those of the novice less easily ensured. The complexity of modern surgery and its requirements rule out so simple a faith in man's capacity to avoid error. Lister met with some fatalities, but he regarded these and others of which he was informed as the result of fear or an error of technique.

In summing up Lister's work in anæsthesia one is struck by its accuracy so far as it went. Modern requirements have called for more and more knowledge, and extended methods

have been given; but Lister's work remains, and the study of his three papers on anæsthesia amply repay the student who reads them.

As to Lister's many other preoccupations, these lie outside the lines of this paper. One is amazed that even his long life was long enough for him to carry through the enormous volume of splendid and original work which stands to his credit. In Sir Rickman Godlee's delightful essay, "Lister, His Place in History,[1] prepended to six of Lord Lister's papers and published in a small volume afford much of interest about matters outside anæsthetics.

1. Six Papers by Lord Lister with a Biography and explanatory notes by Sir Rickman J. Godlee, K.C.V.O. John Bale and Co., 1821. 10s.

BOOK REVIEWS.

"The Science and Art of Anæsthesia." By Col. WILLIAM WEBSTER, D.S.O., M.D., C.M. Henry Kimpton, London. 24/- net.

In this work readers will find the subject of Anæsthesia dealt with from all necessary angles and at just sufficient length to cover the field without undue elaboration. The student who needs a thorough grounding in the essentials of the art; the general practitioner who desires a guide and director; and the regular anæsthetist requiring an occasional refresher will find Col. Webster's excellent work an ideal book to have within easy reach.

The chapter on Ethylene is probably the first to appear in a text-book. The chapters discussing the Patient's View-point, Anæsthesia Records and the Medico-Legal aspects of Anæsthesia make instructive as well as interesting reading, while the treatise generally is ably conceived.

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ANÆSTHESIA AT THE MAYO CLINIC.

By WILLIAM R. MEEKER, M.D., and MARY HINES, R.N.,
Section on Anæsthesia, Mayo Clinic, Rochester, Minnesota.

THE past decade represents a very productive period in the field of anæsthesia. The growing recognition of the importance of anæsthesia, the choice and administration, is at once appreciated when one attempts a review of the literature. New methods of administering general anæsthetics have been developed and the dangers considerably lessened. The evolution has also been marked by the development of new anæsthetic drugs and of various combinations and sequences. These have made the period of induction more pleasant, increased the efficiency of the course of anæsthesia and eliminated many of the dangerous and unpleasant after-effects. The anæsthetist is now accorded the rank of specialist on the operating team, and there is a mutual understanding between surgeon and anæsthetist of each other's difficulties. Great credit is due to our English confrères who have done so much to build up the dignified status of the anæsthetist and the art of anæsthesia, and have developed the clinical value of mixtures and sequences of the different types of anæsthetic agents.

MEDICAL AND SURGICAL CO-OPERATION.

Of even greater benefit to the safety of anæsthesia than progress in the field of anæsthesia proper, has been the enormous advance in surgical technique, and more recently the close co-operation between internist and surgeon in the pre-operative management and post-operative care of poor risk cases. The surgical team now has been enlarged to include the internist and other clinical specialists with their laboratory facilities, each member of the team attending to the particular

problems of his own craft, and at the same time being aware of those confronting his colleagues. As a result of this co-operation the surgical mortality in many dangerous conditions, such as diabetes, exophthalmic goitre, obstructive jaundice and obesity, compares quite favourably with that in cases in which the risk is not increased by these conditions.

Statistics indicate a steady decrease in the mortaliy rate following surgery in diabetes. A mortality of 8 per cent. in 26 operations was reported from the Mayo Clinic in 1915. In 1921 this had decreased to 6.4 per cent. in 233 operations. A further step in advance has been made during the last two years by Wilder and Adams, who report that, as a result of appropriate dietary control and proper administration of insulin, the mortality rate has been reduced in a series of 327 operations on 251 diabetic patients to 1.2 per cent. by operation and 1.6 per cent. by case. One hundred and forty-one of these operations were major surgical procedures, among which were 83 intraperitoneal operations, with a mortality of 3.6 per cent. There were also 26 thyroidectomies, five nephrectomies and seven thigh amputations in cases of gangrene without a fatality. Local anæsthesia was used in this series of cases whenever possible. In the abdominal operations ether was often necessary for the intra-abdominal work.

The surgical mortality rate in cases of exophthalmic goitre is reduced to a certain minimum by strictly surgical technique, skill and judgment. Results have improved with the better recognition of the dangers associated with the surgical management, the increased knowledge of the function of the thyroid gland in health and disease, the discovery of thyroxin and the practical application of basal metabolism, so that at present the mortality from thyroidectomy compares favourably with that of any major surgical procedure. Another important factor in reducing the surgical risk has been due to Plummer's discovery that the peculiar and characteristic crises of this disease can be eliminated by the administration of iodine, and also that this drug will, in many cases, prevent the post-operative hyperthyroid reaction which so often results in death. Pemberton has recently reported a reduced mortality rate in exophthalmic goitre to 1 per cent. by operation and 1.7 per

cent. by case. He regards the avoidance of a prolonged general anæsthesia as important in the reduction of post-operative pulmonary infections.

The extreme danger from hæmorrhage in the presence of jaundice is well known. In a review of the necropsy findings in 27 cases of obstructive jaundice Walters showed that serious post-operative hæmorrhage had occurred in more than 50 per cent., while in cases of unjaundiced patients death from hæmorrhage was exceedingly rare in similar operations. He then instituted a régime of pre-operative preparation, consisting of intravenous injections of calcium chloride, high carbohydrate diet, proctoclysis of glucose solution and calcium lactate by mouth, the efficiency of which was demonstrated by the fact that in a series of 34 patients with obstructive jaundice so prepared there was but one case of serious post-operative bleeding. Combined local anæsthesia and ether was used in this group of cases. Because of the more benign systemic effect of local anæsthesia, this was employed as far as possible, and small amounts of ether added when necessary for intra-abdominal manipulation.

Certain factors must be considered in prostatectomy, which, as a rule, are not concerned in other surgical procedures. The advanced age of the patient is usually associated with conditions that must be kept constantly in mind as influencing the risk in anæsthesia. The mortality rate in this operation has been greatly reduced during the past years, due principally to four factors: (1) the recognition that the patients are potentially uræmic and that adequate pre-operative treatment of this condition is necessary; (2) the increased technical accuracy of the operation; (3) better post-operative care; and (4) the elimination of ether as the anæsthetic. Hunt states that care in the selection of cases, more accurate determination of the time when the patient should be operated on, and the use of anæsthetics that do not depress the action of the kidneys should reduce the mortality rate in prostatectomy to approximately 1 per cent. Many other examples of greatly improved surgical risk could be cited, as a result of close co-operation among surgical team, internist and other clinical specialists with their laboratory facilities. all constituting one closely allied working unit.

Selection of the Anæsthetic.

In the selection of the anæsthetic both surgeon and anæsthetist are agreed that the dominant consideration should be the safety of the patient during both the operation and the harmful after-effects. The second consideration should be the creation of the most favourable operative condition, keeping in mind the personal element of the surgeon and his individual technique in any particular operation. Lastly, the patient's preference and comfort may be considered. If the safety of the patient is to be compromised, the speed or difficulty of induction of anæsthesia, the cost of the anæsthetic, ease and convenience for the anæsthetist, need of more assistants, and the question of quiet in the operating room, should have no bearing in the decision. It is admitted that none of the present-day methods of anæsthesia is absolutely safe, and that no one method is indicated in all cases. In fact, much harm might result from the use of the same type of anæsthesia for all cases. (Table 1.)

TABLE I.

Anæsthesias Administered at the Mayo Clinic during the Years 1922 and 1923.

	1922.	1923.
Ether	7,736	7,107
Local	7,284	7,123
Combined	1,487	728
Nitrous-oxide-oxygen	668	1,571
Spinal	74	8
Nitrous-oxide-oxygen-ether ...	—	398
Ethylene-oxygen	—	324
Ethylene-oxygen-ether	—	332
Total	17,249	17,813

The first question to decide is whether a local or a general anæsthetic should be employed. Until recent years a general anæsthetic, usually ether, was administered in major operations in the absence of contra-indications, and local anæsthesia was relegated to the field of minor surgery. With constantly increasing experience and improvements in technique,

however, the field of local anæsthesia has been enlarged to include many major operations, and its popularity promises to increase. The exact limitations of these two methods of controlling the pain of surgical operations have been the subject of considerable discussion. In fact, the surgical world seems to be in a quandary concerning the claims of anæsthesia by injection on the one hand, and of general narcosis on the other. The usefulness of these two methods varies to a surprising degree with the operation and the personality and predilection of the patient and surgeon.

With regard to the question whether a given operation is suitable for the employment of local anæsthesia, it may be prescribed as a fundamental principle that only such operations should be performed under local anæsthesia as can thus be carried out painlessly to the end, and with relaxation of both tissues and mind. The patient has, in the present status of the science and art of anæsthesia, the right to be operated on painlessly, and the risks of general anæsthesia, rarely very great, should not be unduly exaggerated. The operation, attempted unler local anæsthesia, with the patient strapped on the table, crying with pain, is but a reversion to pre-anæsthetic days. The present furore on the European continent for regional and nerve trunk anæsthesia is probably only transitory. Already many of the pioneers in this field are trying to check this wave of rabid enthusiasm, and are pointing out the limitations and dangers of the method.

The claims of enthusiasts for local anæsthesia that many patients fear unconsciousness and refuse operation under general anæsthesia is greatly over-emphasized. Occasionally patients of the hardier and more phlegmatic types prefer to be awake during operation, but we have seen none who refused operation on learning that the surgeon wished a general anæsthetic. Indeed, for every patient who prefers to retain consciousness there must be at least a hundred who prefer to be " put to sleep." In spite of the conquests of local anæsthesia and its great advantages, when properly handled, " sleep " still maintains its popularity, and provokes no terror in the average patient. The mere relief from pain is not all that is needed, if the operation is to be one that engenders fear, for one of the blessings of general anæsthesia is the

production of unconsciousness. The ideal anæsthetic, therefore, will be that which most nearly approaches physiologic sleep.

Ether Anæsthesia.

It is interesting to observe that, of the many drugs usually listed as general anæsthetics, ether, the one first employed, still maintains its popularity with the great majority of surgeons. From the standpoint of reliability and general applicability, ether has no rival. If one were limited to a single form of anæsthesia, ether by the inhalation method would undoubtedly be chosen. Its great advantages are: ease of administration, immediate safety and profundity of anæsthesia. It is at its best in abdominal operations of moderate length and severity when it can safely be preceded by narcotics and when the patient can assume such a posture after operation that respirations will not be shallow or coughing ineffective. In very severe and long operations that are apt to be followed by much shock, however, and especially when a considerable amount of ether is necessary to maintain the proper depth of anæsthesia, the anæsthesia itself may be the decisive factor against the surgeon's success.

Improved ethers. The ordinary commercial ether prepared especially for anæsthesia contains many impurities. As a result of attempts to purify certain samples of ether, Cotton was convinced that absolute ether possessed no anæsthetic value, and reported work purporting to show that pure ether as a vehicle for ethylene and carbon dioxide had powerful anæsthetic properties. Later, as a result of synthesizing and research, he claimed to have evolved anæsthetic synergists of exceedingly high potency, the exact nature of which he does not divulge, the inference being that they are present in "Cotton-process" ether.

More recently Wallis has introduced a so-called improved ether, under the name of "ethanesal," claimed to be superior to ordinary ether. The claims were also based on the theory that pure ether is less desirable as an anæsthetic than ether containing impurities. Chemical data regarding the preparation of ethanesal were given, but not sufficient to remove it from the semi-secret class of proprietaries.

As a result of a very painstaking investigation the conten-

tion that absolute ether has no anæsthetic action was disproved by Stehle and Bourne, and later by Dale, Hadfield and King. These men even fail to find any anæsthetic potency lacking in pure ether, the principal component of the improved compounds. However, more extended clinical experience has demonstrated only questionable advantages in the improved preparations. After a very limited trial at the Clinic their use was discarded, and at present the improvement of ether is accomplished by its proper mixture with nitrous-oxide-oxygen or ethylene-oxygen.

Method of administration. In all straight ether anæsthesias inhalation by the semi-open drop method is employed. This is a modification of the open drop method, restricting communication with the outside air, and thereby inducing a certain amount of re-breathing. In recent years interest in the rectal and intravenous methods of administering ether has been revived. Only small isolated series of cases, however, are reported, and we are not convinced of their practicability, or of any true indications for either.

Flagg maintains that the rectal method is dangerous. It is unreliable even in the hands of the experienced, and must be supplemented by inhalation. Distension of the bowel is prone to occur, and hæmorrhage and ulceration have been known to follow its use. Injections producing untoward effects frequently cannot be recovered, and often find their way to the cæcum because of reverse peristalsis.

In the intravenous administration a minor surgical operation is first required in order to introduce the cannula into the vein. The proper administration requires familiarity with surgical technique. It is very probable that the patient is harmed by the intravenous injection of 1500 to 2000 saline solution with ether. The blood pressure is raised and bleeding increased. Thrombosis at the point of insertion of the cannula or a septic embolus may occur.

The method of intra-tracheal insufflation was at one time thought to be specifically indicated in thoracic operations for the prevention of collapse of a lung. Further investigations in thoracic surgery, however, have shown that the necessity of preventing collapse of the lung when only one pleural cavity is opened is only theoretical, and that most operations

on the thorax can be quite satisfactorily performed under local anæsthesia, with the addition of nitrous-oxide-oxygen when necessary. The chief difficulty is in the introduction of the tube into the trachea, a special knowledge of technique being necessary. Deep general anæsthesia is also required before the tube is introduced, and the procedure is not without harm to the laryngeal structures. Emphysema of the lungs has occurred, and there is danger of interference with circulation because of the increased intra-pulmonary pressure. These drawbacks will certainly limit the use of this method.

Apparatus and technique. Many complicated apparatuses have been devised, particularly for combinations and sequences and for dosimetric methods. They are so complex in structure and often so difficult to manage that it is impossible to give the patient the close supervision that is necessary. The stopcocks and screws often fail to work at an important time, and leakage of joints is common. Indeed, it has been aptly stated that the inventors and modifiers of these machines are practically the only ones capable of using them. We dispense with all unnecessary paraphernalia and adopt the simplest methods compatible with efficiency.

The question of the necessity of warming anæsthetic vapours no doubt gave rise to more complex apparatus for their administration. The conclusion of Cotton and Boothby, and of McCarty and Davis, based on experimental work, is that the loss of heat directly attributable to warming the anæsthetic vapours is negligible in comparison with that from the body surface. Warmed ether vapour has not been found less irritating to mucous membrane than unheated vapour, and is probably of no value in conserving the energy of the patient by lessening the elimination of heat from the lungs. It is far more important and practical to prevent the temperature of the patient from falling by keeping him dry and warmly covered.

It is not necessary to adopt the dosimetric method of administering ether from the standpoint of safety to the patient. A mechanical dropper is not used, because at times more than a drop is wanted. Good control may be maintained with the ether can fitted with a cork which is notched on opposite sides for the reception of cotton strips.

Fig. 1. Ether administered by the semi-open drop method, stage of induction. The strip of gauze has been folded once around the Esmarch inhaler which is held just above the patient's face.

Fig. 2. Ether administered by the semi-open drop method, stage of maintenance. The gauze has been folded entirely around the Esmarch inhaler, which rests snugly on the patient's face. This method effectively restricts the communication with the outside air and promotes re-breathing; there is, therefore, less likelihood of acapnia.

The Esmarch inhaler covered with two layers of stockinet is employed. The straight drop method is then changed to the semi-drop method by the proper application of a strip of surgeons gauze, one yard wide, folded twice, and about two yards long. The use of this gauze strip, we believe, is more efficient than the use of a towel or rubber dam (Fig. 1).

The period of induction should be practically without excitement or struggle. The mask is gradually lowered to the face, while the patient breathes more frequently and deeply than normally. The anæsthetist begins to fold the gauze over the mask as it rests on the face, while the drop of ether is increased in frequency. Finally the strip of gauze is entirely folded over the mask, the stockinet being exposed at the uppermost point (Fig. 2).

The advantages of this method are many. A smoother anæsthesia results, with the employment of a minimal amount of ether to keep the patient in the best possible condition for the operator. There is less ether in the operating room, less likelihood of acapnia and very little loss of body heat.

Nitrous-Oxide-Oxygen Anæsthesia.

Perhaps no anæsthetic has received so much attention in recent years as nitrous-oxide-oxygen. The exact scope for nitrous-oxide-oxygen anæsthesia cannot at present be defined with certainty. The work of Crile and the experience of the war have done much to enlarge it. In its successful employment, no doubt the personal equation of both surgeon and anæsthetist will be the most important features.

For short anæsthesias, such as pulling teeth, opening abscesses and operations outside of the abdominal cavity, it is the safest anæsthetic known. In prolonged anæsthesias, a half hour or more of this gas is more dangerous than ether. The difficulty which confronts us in nitrous-oxide-oxygen anæsthesia is the necessity of giving nitrous-oxide-oxygen of sufficient concentration to produce anæsthesia and at the same time supply adequate oxygenation. Variations take place within narrow limits, which make it by far the most difficult anæsthetic to administer. The anæsthetist must not only be constantly alert to the ordinary signs of anæsthesia, but must

be able to distinguish shades of lightness and depth which are of no consequence in ether anæsthesia.

The chief objection to this anæsthetic is that it is not efficient. Complete relaxation for prolonged periods is impossible to maintain. Muscular rigidity is usually present in a complete and otherwise entirely satisfactory anæsthesia. A few patients, when preliminary hypodermic narcosis has been administered, relax easily, while others remain rigid no matter how hard the anæsthetic is pushed. When the desired result cannot be obtained without cyanosis ether is added, also in many operations outside of the abdominal cavity, as in thyroidectomy. In many instances local anæsthesia has been added. The principal uses of this anæsthetic then are in minor and less-major operations outside of the abdominal cavity, operations repeated on the same patient at short intervals, and operations on seriously ill patients, particularly those subject to severe shock, and suffering from acute sepsis.

Ethylene-Oxygen Anæsthesia.

The latest competitor for favour as a general anæsthetic is the gas ethylene, introduced by Luckhardt and Carter, of the University of Chicago. After considerable satisfactory experimental work these investigators have submitted it to the profession as a general anæsthetic possessing advantages over those now in use. Although the number of cases in which it has been employed is comparatively small, results thus far are quite gratifying, and its popularity promises to increase.

The use of this anæsthetic was begun on a fairly large scale in August 1923. Since then it has been employed in nearly 2,000 cases. The patients in this series of cases were not selected, but included a large proportion of poor risks. It has been employed in advanced pathologic conditions of the lungs, such as active pulmonary tuberculosis, emphysema, bronchiectasis and empyema. There were patients suffering from diabetes, marked arterio-sclerosis, myocarditis and markedly lowered renal function due to acute and chronic nephritis. In several cancerous patients cachexia and anæmia were extreme. The entire field of general surgery has been covered fairly

well. The proportion of minor operations has been small, whereas many of the more hazardous major operations have been performed.

Safety to the patient. Ethylene-oxygen resembles nitrous-oxide-oxygen more than ether both in its immediate and post-anæsthetic effects. Ethylene produces anæsthesia both by its direct physiologic effects and through its interference with the use of oxygen by the brain cells. When inhaled the gas is dissolved in the blood, but does not form a new chemical compound with hæmoglobin, neither is it decomposed in the body. Experimental observations show that prolonged administration of ethylene alone induces asphyxia by gradual paralysis of the respiratory centre due to the action of the increasingly deoxygenated blood. The hæmoglobin is not changed except that the amount of reduced hæmoglobin always present in asphyxia is increased. Ethylene apparently exerts no solvent action on the lipoids of the brain or other vitally important structures as does ether.

The pulse and blood-pressure are influenced less by ethylene oxygen than by other anæsthetics. The blood-pressure remains almost normal in the more extensive operations, often being lowered 15 to 20 mm. The pulse under full anæsthesia is nearly normal in rate and of regular rhythm and good quality.

The patient's colour and the rhythm and depth of his respiration are the most reliable index as to the amount of oxygen needed in the mixture. During the period of maintenance the respirations are like those of deep physiologic sleep. An important factor in the control of respiration is the extent to which re-breathing is employed. The stimulating effect of the carbon dioxide is similar to that obtained with nitrous-oxide-oxygen anæsthesia, and is more active than that with ether. In our experience respiratory arrest has occurred in but a single instance, in an obese, parturient woman, who promptly resumed respirations after pressure on the chest a few times.

Disagreeable and harmful post-anæsthetic effects may be reduced to a minimum by this method. Ethylene-oxygen does not act as an irritant to the respiratory tract, so that there is usually but a slight increase in mucus or saliva and never

an increased proportion to the extent of the mucus inundation sometimes seen with ether. Sweating is also probably less than with other general anæsthetics, factors tending toward a reduction of the incidence of pulmonary complications.

Vomiting is common, occurring for a very brief time immediately on recovery while the patient is still on the operating table. Usually there are a few retching movements and the vomiting of a small amount of bile-stained stomach secretion. Nausea and vomiting are very rarely troublesome or prolonged. The danger of aspiration is never so great as with other anæsthetics because pharyngeal reflexes are promptly restored as the patient passes to the waking stage.

It should be remembered that ethylene gas is inflammable, and, in certain mixtures with oxygen, highly explosive, and therefore must be used with extreme caution. Under no circumstances should the cautery, free flame, or any source of electric discharge be used during operations with this anæsthesia.

Comfort to the patient. Ethylene-oxygen is probably the most pleasant inhalation anæsthesia, being rivalled only by nitrous-oxide-oxygen. Patients as a rule are anæsthetized very quickly and without the sensation of suffocation associated with ether. The anæsthetic margin being narrow, patients also pass rapidly from the period of maintenance to recovery. It is very rare for a patient to complain about the odour. After a few deep inhalations the odour is no longer noticed, due to the prompt establishment of analgesia. Many patients state that ethylene-oxygen is the most pleasant anæsthetic they have ever taken, and many who from previous experiences dread ether, now request ethylene.

Disagreeable after-effects are few and of no serious concern. Nausea and vomiting are seldom prolonged and serious. There is a lowered incidence of gas pains due to the anæsthetic *per se;* this complaint depends considerably on the amount of operative trauma to the intestines, and when it occurs is not so prolonged or severe as with ether. Thirst is usually not so marked, and food and drink may be given sooner. Nurses notice a much more comfortable convalescence after ethylene-oxygen anæsthesia.

Efficiency of the anæsthesia. The degree of muscular relaxation is intermediate between nitrous-oxide-oxygen and ether. We usually find more or less rigidity. In cases in which absolute relaxation is not essential, ethylene-oxygen is very efficient. There should be a proper understanding of this feature at the outset, the surgeon realizing the conditions under which he is obliged to work, and the anæsthetist the effect he can produce. Otherwise, results may be discouraging from the surgeon's standpoint because of the failure to secure that degree of muscular relaxation on which many operative procedures depend.

The inconvenience to the surgeon of adapting himself to an anæsthetic which does not yield complete muscular relaxation is certainly a serious drawback. A surgeon, who for years has been accustomed to the freedom of manipulation and ease of closure which ether affords, may find it not only difficult but impractical to operate under ethylene-oxygen anæsthesia. In many patients, therefore, and in most abdominal operations, it has been necessary to add certain amounts of ether. Ether is easily added to the ethylene-oxygen mixture, and when full ether anæsthesia is necessary the change is quite smoothly made. When ether is used at the proper time the resulting anæsthesia is of an excellent quality.

The necessity for the addition of ether is emphasized by a summary of the abdominal operations in the first 500 administrations of this anæthesia. In 21 per cent. of 260 abdominal operations ethylene-oxygen alone was sufficient. Ether also was required in 69 per cent. of cases, often in addition to local infiltration of the abdominal wall or parietal peritoneum. In 10 per cent. of these cases, field block of the abdominal wall and ethylene-oxygen, produced satisfactory anæsthesia. In the 240 operations outside of the abdominal cavity ether was added in only 30 cases (12 per cent.). These 30 cases comprised rather extensive operations, particularly the repair of ventral hernias, vaginal hysterectomies, and radical amputations of the breast. The proper understanding of this rigidity at the outset will tend toward intelligent co-operation between surgeon and anæsthetist so that the necessity for greater relaxation will be anticipated.

Local Anæsthesia.

The recent improvement in methods of producing local anæsthesia has greatly increased its usefulness. Continued efforts to broaden the scope of local anæsthesia have gradually evolved the newer methods of field block and nerve block technique, and have tended to establish the system on a more scientific basis. In spite of these improvements, however, it is to be admitted that local anæsthesia has decided limitations and that it has not fulfilled the early hope that it would entirely avoid the dangers of inhalation narcosis.

It is necessary for the surgeon operating under local methods to use an essentially different technique from that commonly employed under general anæsthesia. Speed must often be sacrificed for gentleness. The surgeon should be skilled in clean operative dissections and refrain from unnecessary pulling and handling of tissues. The surgeon who only occasionally attempts major operations under local anæsthesia often courts failure.

It is probably best to inform the patient of the method of anæsthesia to be employed, especially of its advantages to himself. He should understand that the operation requires intelligent co-operation for his benefit. It should also be explained that when anæsthesia begins he will experience a sensation of weight and numbness in the region blocked, and that pull and pressure of the parts may be felt, but that none of these sensations will be painful. The nervous apprehension natural in a patient about to undergo an operation may be considerably allayed by the proper preliminary dosage of morphine and scopolamine. A drowsy, tranquil mental state is thus substituted for one of uneasiness, and the factor of psychic trauma, which may be as productive of shock as physical trauma, eliminated from the operation.

The anæsthetic employed is procain, which replaces with perfect satisfaction the German novocain and the French neocain. A complicated instrumentation for the application of the various methods of local anæsthesia is unnecessary with the proper supply of needles and syringes.

The special metal and glass syringe and needles manufactured by Sharp and Smith, of Chicago, according to Meeker's specifications, are excellent for local anæsthetic work. The

various syringes used for hypodermatization lack the smooth running qualities and durability of this syringe, and the needles as a rule are coarse, non-flexible and short. The Sharp and Smith needles, however, are of different lengths to suit the different anæsthetic procedures, semi-flexible, of an excellent quality of steel, and provided at the base with an automatic locking device which is fastened to the bayonet attachment of the syringe by a quarter turn. The juncture of the nozzle of the syringe and the needle prevents leakage, and the disconnection of the needle from the syringe in making fanwise injections. The rings for the hand grasp enable one to aspirate or fill the syringe with one hand.

Operations on the face and structures of the buccal and nasal cavities. By far the most frequent employment of local anæsthesia is in the minor operations about the nose, throat and face. Local anæsthesia in these locations dispenses with the presence of the anæsthetist and the hindrance caused by his apparatus. The danger of inhaling septic materials is greatly lessened, which in a large measure prevents aspiration pneumonia. That these advantages are real is attested by the fact that most operators who have familiarized themselves with the technique do not abandon it for general anæsthesia.

Alveolotomy with removal of infected teeth is a minor operation quite frequently performed under local anæsthesia. For dental operations it is, as a rule, unnecessary to interrupt the conduction of the second and third main branches of the trigeminal nerve, anæsthesia being induced more distally. In tonsillectomy the tonsils are first painted with cocaine solution, after which complete injection of the base is performed, particular care being taken in injecting the upper and lower poles. The most frequent operations about the face are those for the removal of malignant disease. Infiltration is usually sufficient even for the cautery removal of such growths.

Operations on the cranium. The cranium offers a favourable field for operations under local anæsthesia because of the constant location and accessibility of the nerves supplying the scalp. Operations on the soft parts are readily accomplished under infiltration methods. In turning down an osteoplastic flap, however, the proposed area is entirely surrounded by a wall of anæsthetic solution. The injections should extend

from a point just below the zygoma towards the base of the middle fossa, the needle point taking contact with the bone. When the pericranium is picked up by the needle point and injections made beneath it no pain is felt until the dura is stimulated. The intolerable pain sometimes experienced when the skull is trephined may be relieved by administering a few whiffs of ether at this point. Usually, however, at least the first half of the operation on the cranial contents is easily performed under local anæsthesia, and when general anæsthesia is added the patient is usually awake before the conclusion of the operation. Tumours of the hypophysis have been removed entirely under local anæsthesia.

Operations on the neck. In this region the size of the operative field, the fascial planes and the course and distribution of the nerves of the cervical plexus are all favourable to the employment of local anæsthesia. Terminal infiltration is most commonly employed, although block of the cervical plexus affords a deeper anæsthesia. Local anæsthesia has advanced considerably in favour for thyroidectomy. The greater part of the operation is carried out painlessly, but in the actual dislocation of the gland a short light general or local anæsthesia may be necessary, the patient being fully awake at the conclusion of the operation. Cervical plexus block by the lateral oblique method is sometimes employed in thyroidectomy and laryngectomy. By this technique needles are advanced from above obliquely downward onto the second, third, and fourth cervical transverse processes. The danger of injury to the vertebral artery and vein or puncture of the dura is thus obviated (Fig. 3).

Hernia operations. There is probably no commonly performed major operation that is more inviting to local or regional methods of anæsthesia than that for the repair of hernia. In strangulated hernia infiltration methods are excellent. There is usually a diminution in pain, probably due to pressure on the nerves as they pass through the constricting ring. Dragging and pulling on the organs within the sac may cause pain. In umbilical and ventral hernias the distribution of the nerves involved, usually converging from both sides on the hernia, makes the circular method of field

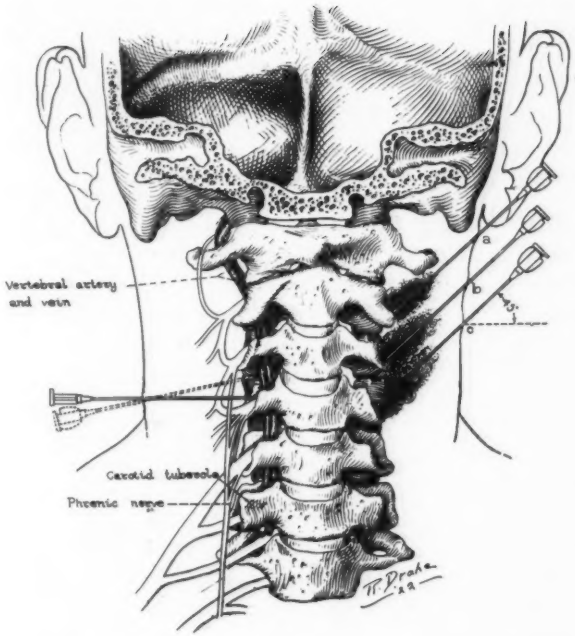

Fig. 3. Lateral methods of cervical plexus block. By the direct method (Haidenhain-Braun) on the patient's right, the danger of entering interspaces and injuring vertebral vessels or puncturing the dura is shown. By the oblique method (Meeker) on the patient's left there is no danger of such an accident. (Stippled areas on the left represent injected anæsthetic fluid.)

block quite applicable. The best subjects are those with lax abdominal walls.

In the repair of inguinal hernia, regional methods are most often employed. A wall of anæsthetic fluid is first projected obliquely across the iliac region from ilium to the margin of the rectus abdominal muscle which anæsthetizes the eleventh and twelfth thoracic, the ilio-inguinal and ilio-hypogastric nerves and their branches. From a point internal to the pubic spine, fanwise injections are made upward in the median line, then laterally along the horizontal ramus of the pubis as far as the femoral vessels. The cord structures are next transfixed and injected at the external inguinal ring. The genital branch of the genito-crural nerve is then blocked by an injection between the iliac fascia and psoas muscle. A point is selected just lateral to the femoral artery and below the inguinal ligament, from which the needle is advanced obliquely upward at an angle between 30 and 45 degrees, while the solution is distributed in a fanwise manner. The addition of a circular injection at the base of the scrotum at the abdomino-scrotal juncture will permit painless operations on the scrotal contents.

Operations on the pelvic floor and viscera. The superficial operations on the perineum and anus may be quite satisfactorily performed under terminal infiltration. Cysts and benign tumours of all kinds, both on the labia majora and minora may be removed by circular field block projected under the base of the growth. Superficial perineal fistulas and fistula-in-ano, when not too painful and in which the fistulous tract is definitely determined, may be encased by a wall of anæsthetic solution. In most cases of hæmorrhoidectomy circumferential injection of the terminal rectum is quite sufficient. The technique is so simple and quickly executed that many surgeons employ it in preference to a general anæsthesia.

The performance of the more extensive operations on the pelvic floor and viscera is often beset with difficulties when attempted under infiltration methods, because of pain produced by traction and the difficulty of exposure. Such difficulty is easily overcome by block of the sacral nerves within the sacral

canal, thus affording an anæsthesia of the entire pelvic floor and its contents.

Clinical experience indicates that the best results are obtained by the use of a very low epidural injection for anæsthesia of the fifth sacral and ano-coccygeal nerves, and trans-sacral block of the upper four sacral nerves. In locating the lateral sacral foramina use is made of their constant relationship to palpable bony prominences, the posterior-superior iliac spine and the sacral cornua (Fig. 4). The previous injection into the epidural space through the sacral hiatus provides partial anæsthesia for the trans-sacral procedure.

The extent of local anæsthesia is best appreciated by a consideration of the variety of operations which may be performed under it (Fig. 5). It has been employed in all rectal operations by the perineal route, including the Kraske posterior resection. Gynæcological operations have included perineorrhaphies, the Bovee and Clark operations for cystocele, trachelorrhaphy, dilatation of the vagina, vaginectomy, vaginal hysterectomy, the Watkins' interposition operation, and the removal of cancer of the rectovaginal septum. External urethrotomy and plastic repair of perineal urinary fistulas have been performed in the male. In urology it has been employed for anæsthesia of the bladder, prostate and urethra after epidural anæsthesia alone has been found insufficient. Together with suprapubic field block, anæsthesia for prostatectomy and resection of the bladder by the suprapubic route is very satisfactory.

Thoracic and Lumbar Paravertebral Nerve Block.

Aside from the cervical and sacral regions we have found parvertebral nerve block to have but a limited sphere of usefulness. It is most satisfactory in laminectomy and in the Hibbs' operation, in which anæsthesia of the anterior divisions and sympathetic communicating rami is not necessary. It may be employed in thoracoplastic work, although the nerves are usually more easily accessible farther along their courses.

It was originally hoped that in bilateral paravertebral nerve block a practical method of local anæsthesia for abdominal operations had been evolved. After a complete trial this

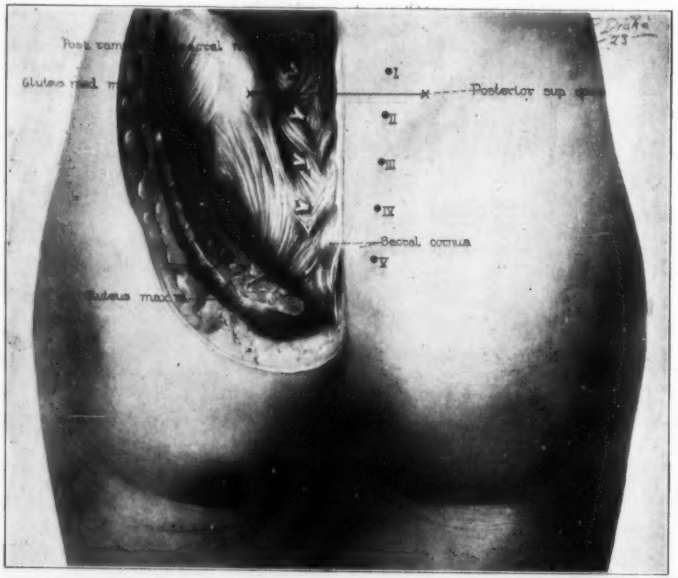

Fig. 4. Regional anatomy of sacral nerves and foramina. Cutaneous landmarks on right mark foramina. Note relation to posterior superior spine and sacral cornu.

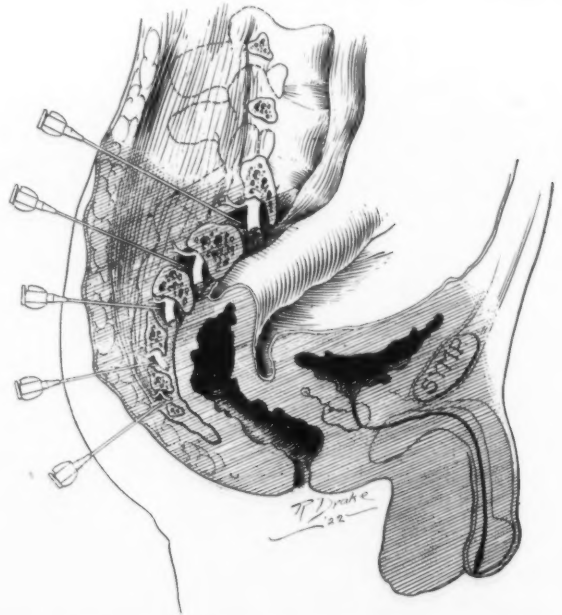

Fig. 5. Median longitudinal section of pelvis anterior to sacrum, and oblique longitudinal section through right sacral foramina. Note progressively decreasing length and diameter of the foramina from above downward, and the decreasing size of nerve trunks. (Shaded area represents the extent of anæsthesia.)

method has been abandoned even by the early advocates. As is evident anatomically, the technique is highly complicated, time consuming and tedious, which would not of itself be a great disadvantage if anæsthesia were not so often incomplete and never of the type of "abdominal silence" as in ether narcosis or spinal anæsthesia. The deep, and by no means painless injections have to be made from several points. Often repeated search in the same interspace must be made, and the field tested and re-injected even by the most expert, making the anæsthetic procedure an extensive operation in itself. In spite of deep preliminary hypodermic narcosis an insufficient nerve block anæsthesia must be supplemented by inhalation anæsthesia. The injections themselves are not free from risk, and toxic symptoms are often produced by the large amount of solution employed. It is not surprising then that no rivalry exists between bilateral paravertebral nerve block and general anæsthesia for abdominal operations.

Splanchnic Nerve Block.

More recently attention has been turned to interruption of conductivity of the splanchnic nerves, and during the past five years many small series of abdominal operations under this type of anæsthesia have been reported. This procedure is based on the erroneous conclusion that the intra-abdominal pain during operation is visceral pain conveyed centrally over the splanchnic nerves. The abdominal viscera themselves, however, have, time and again, been shown to be insensible to pain in so far as the cutting, crushing and cauterizing of operative work do not constitute the adequate stimulus to the production of such pain. This fact was first observed and extensively studied by Lennander and McKenzie, and has since been confirmed by the whole host of surgeons operating under local anæsthesia, and is, therefore, incontrovertible by animal experimentation.

A close analysis of the patient's behaviour during an upper abdominal operation under local anæsthesia without splanchnic nerve block as compared with a similar operation with the splanchnic nerves blocked shows that pain is produced by the same stimuli in both cases. This pain arises from stimulation of spinal nerve filaments innervating parietal peritoneum,

bases of mesenteries and rim of the diaphragm, and not from sympathetic nerves. Traction on viscera is the most frequent cause of pain, and is tolerated much less when there are adhesions to parietal peritoneum. Pain is experienced when saline packs are placed between viscera and parietal peritoneum, and when they are removed, but placing compresses between different viscera is not painful when the parietal peritoneum is carefully avoided and no traction on mesenteries made. At present, therefore, success in abdominal operations under local anæsthesia still depends on the proper selection of cases, deep preliminary hypodermic narcosis, and on very gentle management after laparotomy. Block of splanchnic nerves is the feature of least importance for such success; indeed, its only possible value in addition to toxic depression is block of the spinal rami proceeding to the base of the mesogastrium at the site of injection.

Spinal Anæsthesia.

There is still a good deal of difference of opinion with regard to the proportion of cases in which spinal anæsthesia is indicated. It is rarely employed at the Mayo Clinic. The extension of local anæsthesia to include many pelvic and perineal operations formerly performed under spinal anæsthesia has limited the usefulness of the latter.

Improvement in the last few years in the technique of spinal anæsthesia has been due largely to the employment of the least toxic drugs, novocain and apothesin, in the subarachnoidal injection. Exaggerated reports of the innocuousness of the method, however, have served only to discredit the procedure where its use might otherwise be valuable. Such statements, for example, as "absolutely safe," "without mishap," "anæsthetic of choice," and so forth, are applied to spinal anæsthesia in the same publications which also detail methods of resuscitation in cases of collapse. Even those who use it most insist that one must be prepared to meet emergencies. Although usually beneficial, there may be manifestations of danger. In the course of an otherwise successful surgical procedure the vasomotor apparatus may give way. The resulting fall in blood pressure is sometimes extreme. The patient turns pale, perspires, and is distressed. Whether

or not this condition is one of shock, the pictures are very similar, and while these symptoms usually pass away in a comparatively short time, their presence is very disquieting, and it is impossible to predict in which cases such symptoms are liable to occur. Mortality with spinal anæsthesia shows it to be more dangerous than other methods. It is debatable whether for every condition requiring an anæsthetic we have not safer and more efficient methods at our disposal. At present its principal use in the Clinic is in amputations and the more extensive operations on the lower extremities in which general anæsthesia is contraindicated.

Conclusions.

1. The close co-operation between surgeon and other clinical specialists with their laboratory facilities in the pre-operative management and post-operative care of poor risk cases has greatly improved the prognosis of operation, and hence has considerably minimized the hazard of anæsthesia.

2. Ether by the semi-open drop method is the standard anæsthesia at the Mayo Clinic when a prolonged anæsthesia with relaxation and unconsciousness is desired. From the standpoint of reliability and general applicability, ether has no rival.

3. Nitrous-oxide-oxygen is employed in short anæsthesias, in operations outside of the abdominal cavity, in special cases in which the operation is likely to be followed by considerable shock, and in cases in which the patients are suffering from severe sepsis.

4. The new gas anæsthetic, ethylene-oxygen, seems to possess certain advantages over those now in use, although clinical experience with the method is comparatively small. It is characterized by a certain amount of muscular rigidity, and in abdominal surgery the addition of ether is necessary in order to secure that degree of relaxation on which the success of many abdominal operations depends.

5. In spite of the recent improvements in the technique of local anæsthesia, it has not fulfilled the early hope that it would entirely avoid the dangers of inhalation narcosis. The usefulness of this method varies to a surprising degree with the operation, and the personality and predilection of the

patient and surgeon. Its use in topographically isolated operative fields in which the nerve trunks are easily accessible is quite gratifying. Aside from minor surgery its most frequent use is in operations about the neck and cranium, the repair of hernias, and in operations on the pelvic floor and viscera. It is least successful in the more extensive abdominal operations. Bilateral paravertebral nerve block and splanchnic nerve block methods do not facilitate the performance of these operations under local anæsthesia.

6. It is questionable whether for every condition requiring an anæsthetic we have not safer and more efficient methods at our disposal than spinal anæsthesia. At present its principal use at the Mayo Clinic is in amputations and the more extensive operations on the lower extremities in which general anæsthesia is contraindicated.

BIBLIOGRAPHY.

1. Bevan, A. D. The choice and technique of the anæsthetic. *Jour. Am. Med. Assn.*, 1915, lxvi, 1418—1423.
2. Boothby, W. M. Ether anæsthesia. In Keene's "Surgery." Philadelphia, Saunders, 1921, viii, chap. lviii, pp. 824—836.
3. Cotton, F. J., and Boothby, W. M. The uselessness of warming anæsthetic vapours. *Surg., Gynec. and Obst.*, 1912, xv, 724—726.
4. Cotton, J. H. Anæsthesia from commercial ether-administration and what it is due to. *Can. Med. Assn. Jour.*, 1917, vii, 769—777.
5. Cotton, J. H. Cotton process ether and ether analgesia. *Am. Jour. Surg.* (Anæs. Supp.), 1919, xxxiii, 34-43.
6. Dale, H. H., Hadfield, C. F., and King, H. Anæsthetic action of pure ether. *Lancet*, 1923, i, 424—429.
7. Editorial. An improved (?) ether. *Jour. Am. Med. Assn.*, 1923, lxxxi, 1025—1026.
8. Editorial. Propaganda for reform. So-called improved ethers. *Jour. Am. Med. Assn.*, 1923, lxxxi, 1040.
9. Flagg, P. J. The art of anæsthesia. Philadelphia: Lippincott, 2nd ed., 1919, chap. lv, Ether anæsthesia, pp. 120—180.
10. Herb, Isabella C. The selection of an anæsthetic. *Surg. Gynec. and Obst.*, 1912, xv, 223—226.
11. Hunt, V. C. Surgery of the prostate. *Minn. Med.*, 1921, iv, 544—548.
12. Labat, G. L., and Meeker, W. R. Inguinal herniotomy under regional anæsthesia. *Surg., Gynæc. and Obst.*, 1922, xxxiv, 398—503.

13. Luckhardt, A. B., and Carter, J. B. Ethylene as a gas anæsthetic. *Jour. Am. Med. Assn.*, lxxx, 1440—1442.
14. Luckhardt, A. B., and Lewis, D. Clinical experiences with ethylene-oxygen anæsthesia. *Jour. Am. Med. Assn.*, lxxxi, 1851—1857.
15. Luke, H. C. Ether-oil rectal anæsthesia : some theoretical considerations. *Med. Rec.*, 1914, lxxxv, 839—840.
16. MaGaw, Alice. Review of over fourteen thousand surgical anæsthesias. *Surg., Gynæc. and Obst.*, 1906, iii, 795—799.
17. McCarty, F. B., and Davis, B. F. The use of warmed ether vapour for anæsthesia. *Ann. Surg.*, 1916, lxiii, 305—311.
18. Meeker, W. R. Regional anæsthesia in surgery of the prostate gland and bladder. *Journal-Lancet*, 1924, xliv, 1-6.
19. Meeker, W. R. Splanchnic anæsthesia : an analysis of forty-two cases. *Arch. Surg.*, in press.
20. Meeker, W. R. Surgery of the scrotum and its contents under regional anæsthesia. *Jour. Urol.*, 1922, viii, 61—73.
21. Meeker, W. R. The use of paravertebral nerve block anæsthesia in general surgery. *Minn. Med.*, 1923, vi, 138—152.
22. Meeker, W. R., and Bonar, B. E. Regional anæsthesia in gynæcology and obstetrics. *Surg., Gynæc. and Obst.*, 1923, xxxvii, 816—840.
23. Meeker, W. R., and Frazer, E. B. Trans-sacral nerve block anæsthesia in surgery of the pelvic floor and viscera. *Surg., Gynæc.* and Obst., 1922, xxxv, 801—812.
24. Pemberton, J. de J. Mortality in surgery of exophthalmic goitre. *Surg., Gynæc. and Obst.*, 1923, xxxvi, 458—462.
25. Plummer, H. S., and Boothby, W. M. The value of iodin in exophthalmic goitre. *Jour. Iowa State Med. Soc.*, 1923, xiv, 66-73.
26. Scholl, A. J. Sacral anæsthesia in urology. *Am. Jour. Urol.*, 1921, vi, 149—171.
27. Stehle, R. L., and Bourne, W. The anæsthetic properties of pure ether. *Jour. Am. Med. Assn.*, 1922, lxxix, 375—376.
28. van Hook, W. The place of nitrous oxide oxygen-ether anæsthesia in surgery. Current researches in anæsthesia and analgesia, 1923, ii, 210—220.
29. Wallis, R. L. M., and Hewer, C. L. A new general anæsthetic : its theory and practice. *Lancet*, 1921, i, 1173—1178.
30. Wilder, R. M., and Adams, S. F. The present status of the diabetic patient as a surgical risk. *Wisconsin Med. Jour.*, 1924.

BLOOD CONCENTRATION AND BODY TEMPERATURE IN ANÆSTHESIA.[1]

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IN a recent communication[1] data were presented which show, firstly, that dogs under the influence of ether maintain their normal body temperature only when the temperature of the surroundings is very near to 31°C. in either wet, or dry, gently fanned atmospheres; secondly, that irrespective of environmental conditions, ether always causes blood concentration; and thirdly, that when water or hypo-tonic solutions are administered prior to ether the blood concentration is markedly reduced, but body temperature is lowered.

In an attempt to conserve concomitantly the normal levels of blood fluidity and of body temperature it was decided to conduct a series of experiments with a further reduction in the cooling power of the environment, using dogs which had had liquids. The temperature chosen was that of 33°C. In all other respects the conditions and methods were identical with those previously described.[1] The results are set forth at Table I. It may be seen that there is a better maintaining of body temperature than that at the previously reported optimum, and this is accompanied by variable slight increases in the blood solids.

It is worthy of note that in experiments Nos. 21 and 22 water was given by mouth, and in each instance there was not only good maintaining of body temperature but also minimal blood concentration. (These facts compare well with those of

1. From a paper read before a meeting of the Canadian Society of Anæsthetists at Ottawa, June 17th, 1924.

experiments previously reported in which water alone was used hypodermically.[1])

It may be mentioned that chloroform was the anæsthetic employed in experiment No. 22, and here there were neither changes in body temperature nor blood solids.

TABLE I.

EFFECTS OF ETHER OR CHLOROFORM AT 33°C. DRY AIR AFTER ADMINISTRATION OF FLUIDS.

Expt. No.	19	20	21	22
Fluid (one hour before anæs.)	3% Dextrose	3% Dextrose	Water	Water
Avenue	Subcutaneous	Subcutaneous	Stomach	Stomach
Temperature °C. of chamber.				
Dry bulb	33.0	32.6	33.0	33.0
Wet bulb	22.8	22.7	21.1	21.4
Kata-thermometer mil. cal. per sq. cm. per sec.				
Dry	.82	.80	.75	.96
Wet	9.8	8.4	8.8	9.8
Temp. °C. of animal before fluid	38.3	38.0	39.55	38.2
Temp. °C. of animal after fluid	38.8	38.2	39.0	37.95
Temp. °C. of animal after ether and one hour in chamber	38.7	37.0	39.1	38.2
Net change from normal	+0.4	−1.0	−0.45	0.0
Blood solids per cent. before fluid	22.3	22.6	18.5	21.0
Blood solids per cent. after fluid	22.1	23.4	17.5	20.6
Blood solids per cent. after one hour ether in chamber	25.1	24.7	19.8	21.0
Net change from normal	+2.8	+2.1	+1.3	0.0

TABLE II.

EFFECTS OF MORPHINE-ETHER AT MODERATELY INCREASED ROOM TEMPERATURE (ABOUT 25°C.).

Expt. No.	24	25	26	27	28	29
Temperature °C. of chamber.						
Dry bulb	24.95	25.7	25.5	25.2	25.0	25.2
Wet bulb	15.3	15.1	16.8	15.6	13.6	13.8
Kata-thermometer mil. cal. per sq. cm. per sec.						
Dry	3.1	2.8	2.9	3.25	2.88	3.78
Wet	13.1	13.6	12.7	12.29	13.77	13.77
Temp. °C. of animal before morphine	38.3	38.2	38.15	38.6	38.5	38.5
Temp. °C. of animal after morphine (one hour) ...	38.0	37.0	38.15	37.3	37.5	37.7
Temp. °C. of animal after ether (one hour)	36.3	36.8	37.0	36.5	36.4	36.5
Net change from normal ...	−2.0	−1.4	−1.15	−2.1	−2.1	−2.0
Blood solids per cent. before morphine	19.3	21.5	19.7	22.5	23.5	24.7
Blood solids per cent. after morphine (one hour) ...	20.5	24.7	21.2	22.5	22.6	23.6
Blood solids per cent. after one hour ether	20.5	24.8	21.3	23.1	23.8	24.3
Net change from normal ...	+1.2	+3.3	+1.6	+0.6	+0.3	+0.4
Net change after ether from morphine	0	+0.1	+0.1	+0.6	+1.2	+0.7

The lowered cooling power of the environment may be seen from the recorded Kata-thermometer figures, namely, 0.8 dry and 9.2 wet.

The previously expressed view, that during anæsthesia some of the water which leaves the blood may go to the tissues, is strengthened by the results of other work done in this laboratory[2] on rats, when it was found that after ether anæsthesia the water content of the muscles was increased.

Attention was now turned to the effects on body temperature and blood concentration when morphine is administered before ether.

These observations were made in the same constant temperature chamber at a temperature of approximately 25°C. Morphine sulphate 10 mg. per kilo was administered hypo-

dermically one hour before etherization. The results are given in Table II. It will be seen that whereas morphine at this environmental temperature over a period of one hour causes only a slight fall of body temperature the superposition of ether anæsthesia is accompanied by a marked fall in temperature.

The changes in blood concentration are remarkable in that morphine, with one exception, causes very slight changes in percentages of solids in the blood within an hour, and after ether is administered the usual increase in blood solids is almost completely offset.

It is difficult to understand the exception mentioned above, namely, that of experiment No. 25, in which there occurred marked blood concentration after morphine, and all the more so seeing that the same dog was used at experiment No. 29 when there was practically no change in the blood solids.

This morphine-ether effect is all the more interesting when considered along with the fact that it has been found in this laboratory[3] that morphine-ether anæsthesia produces a much greater degree of hyperglycæmia than that of ether alone, which confirms our belief that glucose should not be given before, during or immediately after ether or chloroform.

Conclusions.

1. With an elevation of the environmental temperature to 33°C., accompanied by the administration of fluids, there result negligible changes in either body temperature or blood solids in anæsthetized dogs.

2. Morphine administered prior to ether protects the animal against blood concentration.

3. For etherized dogs the optimum "dry" and "wet kata cooling power" of the environment lies near 0.8 and 9.0 millicalories respectively when fluids are administered.

REFERENCES.

1. Barbour, H. G., and Bourne, W. *Amer. Journ. of Physiol.*, vol. 67, No. 2, Jan., 1924.
2. Stehle, R. L., and Bourne, W. Unpublished Work, Dept. of Pharmacology, McGill University, Montreal.
3. Stehle, R. L., and Bourne, W. *Journ. of Biol. Chem.*, vol. lx, p. 17, 1924.

SCOTTISH SOCIETY OF ANÆSTHETISTS.

The Annual Meeting of the above Society was held at the Royal College of Surgeons, Edinburgh, on 17th May, 1924.

Dr. FAIRLIE read his Presidential Address on the subject of

ANÆSTHESIA, ITS PRESENT POSITION.

We have had many papers on particular aspects of anæsthesia at the meetings of this Society, but we have not had for some time, if ever, any attempt at a general survey of the subject. On having the honour of President conferred upon me I thought, therefore, that the more general aspects of our science and art might be made the subject of my remarks, with special attention to the more recent developments. Whatever subject I chose I was faced with the difficulty of saying anything of real interest and value to the Society. Therefore, in deciding on this subject, and especially in commenting on recent developments, I have sought rather to give my own personal expression of opinion on aspects and methods of which I myself have had experience, than to read extracts from recent literature with which you are all probably more famliiar than I am. I quite realise the dangers of this course and apologise for the inadequacy of my treatment. I have no doubt you will discover many serious omissions, and, on the other hand, undue emphasis on certain points which do not deserve it.

I thought that the subject might very well be introduced with a consideration of the position and status of the anæsthetist. While in London the administration of anæsthetics has been more or less in the hands of the specialist since soon after the discovery of the anæsthetic properties of ether and chloroform, such names as Clover and Snow being sufficient reminders of this fact, in Scotland the specialist is of more recent origin. Up to very near the end of last century few, if any, turned their attention in any special way in that direction. Perhaps the reason lay in lack of encouragement. The surgeon depended, to a considerable extent, for the anæsthesia of his patient, on assistant, house surgeon, or the general practitioner in charge of the particular patient on whom he was operating. Whatever the reason, this custom prevailed very generally in Scotland till about 25 or 30 years ago. I cannot speak for Edinburgh or any of the other centres in Scotland except Glasgow, but in the latter city I believe Dr. Henderson, father of one of our members, was the first to make any attempt to specialise in anæsthetics. With the amazing developments which have taken place in surgery during those years

the demands on the administrator of anæsthetics has grown, and as a result, the need for the expert has become more and more urgent, until now he (or she) has a very definite place in every surgical centre. As far as we can judge this place is likely to remain established so long as surgery is practised, or until a better method of allaying pain is discovered. Established then, as a definite entity in medicine, the anæsthetist in Scotland can regard with satisfaction the improvement which has gradually taken place in his lot. It has taken time for the old idea to be uprooted, that anyone who happened to be at hand was good enough to give an anæsthetic.

No doubt there is still room for improvement in certain directions. Our discussion of a year ago, on the perhaps sordid but very vital question of ways and means, bears testimony to that. Another direction in which improvement would be welcome to many of us is in the information vouchsafed to us in the booking of appointments. It is hardly justice to patient, surgeon or anæsthetist to have the bare fact of an appointment at a certain time and place communicated. There is a considerable difference in the methods required for anæsthetising, say, a whitlow, a cholecystitis, a goitre, and a cleft palate. An indication as to the nature of the operation to be performed would be a great help to all concerned.

On coming to the consideration of the anæsthetics at our command I am not in a position to venture an opinion on the value of such recently introduced anæsthetics as acetylene and ethylene, and will confine my remarks to those which have been in more general use, glancing at the newer methods of administering them. On the old controversy on the respective merits of ether and chloroform I do not intend to say much. Judging from recent contributions to medical literature it is as lively in its old age, or shall I say middle age, as it was in infancy. I am not one of those who considers chloroform a back number, though, on the other hand, I do not look upon it as the routine anæsthetic. No more do I adopt ether as a matter of course. My choice of anæsthetic, whether ether, chloroform, or other drug, depends on the exigencies of the particular case.

There are three points in connection with chloroform on which I should like to touch :—

(1) I do not go with such writers as Flagg who says in his recent edition of " The Art of Anæsthesia : " In the author's experience, chloroform has completely given way to ether administered by intrapharyngeal methods. This condition holds with the single exception of oral cases in which the actual cautery is used." If it is to be used, however, it should be done with very great circumspection, and, in my opinion, by some form of dosimetric apparatus which controls the vapour strength, so that it may be given evenly, and not in widely and rapidly changing percentages. Levy's work has amply stressed the importance of this, though it seems to me he under-estimated

the part played by actual over-dosage in chloroform collapses and fatalities.

(2) It should not be given at all in acute sepsis, particularly of the abdomen, because of the risk of acidosis.

(3) It should not be used except by the expert. Adequate anæsthesia can be maintained, and anæsthetic mortality considerably reduced, by a more general employment of open ether, in the hands of house surgeons and those who only occasionally give anæsthetics.

In turning to ether, so many new methods and appliances have been introduced that it is almost impossible to keep up to date. To me the most valuable innovation in giving "open" ether is the perhalation method which Dr. Ogston described to us two years ago. It combines in a marked degree simplicity and efficiency. A slight modification of it which I find most useful is to combine it with the Bomb method of Wilson and Pinson, leading the tube from the bomb between the layers of gauze in Ogston's mask, and thus introducing warmed vapour instead of dropping liquid ether on to the gauze. In addition to the advantage which the warm vapour gives, there is also the freeing of the hand which is usually occupied with the drop bottle.

Shipway's apparatus for warmed chloroform and ether vapours I find invaluable in face, mouth, and nose operations, where a mask is inconvenient to the surgeon. I use it mostly as an ether inhaler, but find it convenient to have chloroform at hand to deepen the anæsthesia when necessary. Rectal anæsthesia, using Gwathmey's ether oil mixture, I have found of great service in laryngoscopic and bronchoscopic examinations.

The method which I have found the greatest advance in the science of anæsthesia is the intra-tracheal method, either with ether or chloroform. It has not been my privilege to handle a Mott's apparatus which I should imagine to be the last word in perfection, but even with less perfect appliances the gain over other methods, in certain cases, is very marked; admittedly in certain cases, for it has not been recommended as a routine method. The confidence which it inspires both in surgeon and anæsthetist in four classes of operations is of a nature that no other method achieves. These four classes are:

(1) Extensive face and intra-oral operations.

(2) Removal of goitres or other tumours about the neck.

(3) Lung surgery.

(4) Any operation entailing awkward positions for the patient.

Although gas and oxygen has been used for anæsthesia for over fifty years, its vogue has greatly increased lately. With the introduction of sight-feed appliances and accessory ether or chloroform bottles, it has been possible to administer it much more successfully than by the older methods. Like many other anæsthetics which have from time to time been hailed as the introducers of a new era,

it has suffered a rather severe eclipse lately, and the pendulum has swung over to the other extreme. We have all, no doubt, read very scathing criticisms of gas and oxygen recently. Probably opinion will eventually take up a position between the two extremes. Gas and oxygen anæsthesia has very definite limitations, but having strict regard to those it makes an almost ideal anæsthetic in its own field. Administered after preliminary narcotics, with rebreathing, and with the minimum of ether or chloroform, it possesses very pronounced advantages in operations where a great degree of muscular relaxation is not demanded. Even in the latter class of case more use may well be made of it provided the surgeon is prepared to use novocain locally in the tissues of the abdominal wall.

I do not restrict the use of oxygen to its accompaniment of nitrous oxide. My inclination is to use it more and more along with ether and especially chloroform. The underlying idea is the same in each case. Any mixture of anæsthetic vapour and atmospheric air suffers from the high proportion of nitrogen. If the need for deep anæsthesia arises this acts as a handicap. In other words, anæsthesia may be pushed further, with a greater degree of safety, in presence of a higher proportion of oxygen than the atmosphere contains. So in abdominal operations, particularly those of the upper abdomen, I frequently find a stream of oxygen led under the mask of great assistance. It prevents the onset of cyanosis with accompanying rigidity. It is useful in any operation where the patient, for one reason or another, has a tendency to cyanosis.

In bringing this brief review to a close there are certain important omissions for which I must give reason. I have said nothing about nitrous oxide administered alone, nor ethyl chloride, not because I do not use them, but because I have nothing of any special interest to say about them. Then I have touched very slightly on special methods for anæsthetising in oral and nasal operations, lest I should trespass on the ground which Dr. Gibbs is about to traverse in his paper. For this reason I have omitted entirely any reference to continuous nasal gas. And lastly I have made no reference to spinal anæsthesia from the feeling that it would introduce too large a subject and one which deserves a paper to itself.

At the conclusion of Dr. Fairlie's paper a discussion followed.

Dr. J. S. Ross thought it was important that the administration of chloroform should not become a lost art and that it should be adequately taught to students. With regard to rectal anæsthesia he considered that if surgeons would inform the anæsthetist in advance of patients who were terror-struck, rectal anæsthesia might have a wider field of usefulness. He was glad to hear Dr. Fairlie's remarks with regard to the use of oxygen apart from nitrous oxide and oxygen. He considered that no theatre was properly equipped if it did not contain an oxygen cylinder with oxygen in it. It was absurd for

the anæsthetist to have to carry an oxygen cylinder to large nursing homes for his personal use. With regard to nitrous oxide and oxygen he considered its dangers lay in attempting to handle with it patients of too powerful a type, and in being ashamed to use adjuvants such as ether or even chloroform in low percentage strength, for a brief period. Recently he had used in his ether bottle a mixture of ether 90 per cent. and chloroform 10 per cent., and found that he got much quicker control of the patient, and had improved his results very much. Many years ago he had personally experienced a death under nitrous oxide and oxygen which he was now satisfied would not have occurred had he made more use of adjuvants and thus avoided any necessity for undue oxygen deprivation.

Dr. Ross Mackenzie (Aberdeen) agreed with previous speakers that students should be adequately instructed in the administration of chloroform. He would go the length of giving alternate ether and chloroform cases when teaching students. At the Sick Children's Hospital, Aberdeen, the majority of cases were conducted under nitrous oxide and oxygen, combined with very careful use of novocain infiltration. This combination in his experience covered the largest field in children. An unusually high proportion of oxygen was necessary and a mere trace of ether vapour during the induction period. There was very little after-sickness and a very rapid recovery. He had used rectal ether a good deal in children and liked the immediate results, but the method threw a good deal of work on the nursing staff, and the surgeons were inclined to think that there was more after reaction than with the inhalation method.

Dr. Ogston (Aberdeen) believed that very good results could be got with gas-oxygen combined with novocain infiltration. He thought the best relaxation was obtained by blocking the intercostal nerves as they emerged from the lower spaces. He wondered whether the drugs now available were as good as those we had pre-war; the results did not seem quite so good.

Dr. Johnston (Aberdeen) agreed as to the value of oxygen given with any anæsthetic. It was particularly useful when using ethyl chloride as a preliminary to open ether sprayed on the mask. There was apt to be some cyanosis just as the patient was going under, and a whiff of oxygen at this stage was very beneficial. He had used rectal anæsthesia for operations about the mouth and nose, but was now rather shy of it, as he had experienced a good deal of after-sickness.

Dr. Mills (Dundee) did not agree as to the teaching of chloroform to students. It was far more important to teach them its dangers, and to get them accustomed to other methods. As regards intra-tracheal he thought that in many nose and throat operations its place could well be taken by intra-pharyngeal ether, if the surgeon were careful to mop blood out as he went along.

Dr. J. S. FREW (Glasgow) confirmed the value of oxygen with anæsthetics other than nitrous oxide.

Dr. F. L. NAPIER (Glasgow) had come to rely very largely on the Shipway apparatus, using a trace of chloroform with the ether. He used oxygen gas to bubble through the ether instead of air.

Dr. BARRAS (Glasgow) agreed with Dr. Napier. He, however, had a side tube direct from the oxygen cylinder to the patient for use in emergencies. Where malignant disease was present in the mouth he avoided intra-tracheal if possible, as he considered it quite a possibility that the catheter might carry infection down into the lung.

Dr. TORRANCE THOMSON considered it certain when out in the world young practitioners would use chloroform very freely and he therefore considered it essential that in their student days they should be taught it. He used oxygen both with open and closed ether and had found Pinson's oxygen valve of great value. He was a warm advocate of the use of the intra-tracheal method for abdominal sections, particularly for a high operation such as gall bladder. He had had good results with nitrous oxide and oxygen given by this route but found it very expensive. He had had very good results with ethenesal but upon the whole he doubted whether it was really any better than a good brand of ether. For some months he had been using the Pinson Bomb and regarded it upon the whole as the best method for open ether.

Dr. LOGAN TURNER expressed his appreciation of the invitation to him by the Society to attend the meeting and join in the discussion. He had always favoured the closest co-operation between various specialists and certainly betweeen the surgeon and the anæsthetist. He quite agreed that the anæsthetist should be informed precisely of the nature of the case and of all relevant points in connection with it as soon as the appointment was made. In these days he had found very often that the anæsthetist's preparations required to be as complicated as or more so than those of the surgeon.

Dr. FAIRLIE thanked the Society for the reception given to his remarks. With regard to the teaching of the students he personally favoured a deliberate attempt being made to wean the new members of the profession altogether from the habitual use of chloroform and thought therefore that in teaching all the emphasis should be laid upon the simpler methods of giving ether. He agreed with Dr. Thomson that ethenesal had no advantages over a good brand.

Dr. J. H. GIBBS opened a discussion upon " Methods of Anæsthesia in Nasal, Dental and other Oral Operations." He explained that he would simplify his remarks by speaking mainly of the methods which he personally used and would exclude mostly from his observations the question of individual peculiarity in the patient, considering the anæsthetic solely in connection with the locality or disease to be dealt with and not with any constitutional complaint such as cardiac

or pulmonary disease. Mouth and nose operations had this peculiarity that the interests of the surgeon and anæsthetist in many cases seemed to clash; each wanted to get at the patient at the same time. If ether was to be given he insisted upon a preliminary dose of atropin. One hundredth of a grain was usually an adequate dose. If hæmorrhage was not likely he added heroin or morphia. Upon the whole he thought that heroin gave less after effects. His stock method for longer cases, such as antrum operations, was to induce with ethyl chloride and ether given with the Clover instrument and then change over to a Junker or Shipway, passing the vapour where possible along a catheter through the nose into the pharynx. For tonsils or adenoids in subjects up to 12 or 14 years of age he habitually used ethyl chloride, regarding 4 cc. as the maximum dose. Latterly he had been adding 1 cc. of ether and desired an expression of opinion from other members as to whether this addition increased the safety of ethyl chloride. For enucleation of tonsils, for which ethyl chloride alone would be inadequate, he used the Clover method of ether, getting a forecast from the surgeon as to the length of time which it would be desired the patient should remain under the anæsthesia. Here it was very necessary that the patient should have atropin, but morphia was undesirable. For paracentesis of the antrum nitrous oxide often sufficed. For mastoid operations he induced with ethyl chloride and ether in the Clover instrument and followed up with open ether. For dental work he found that nitrous oxide or nitrous oxide and oxygen as a single dose anæsthetic sufficed for anything up to three teeth as a rule. For cases taking a little longer than this he added 1 cc. of ethyl chloride at the last moment. The patients need only take about five breaths of this, and some 10 seconds or more were thus added to the available anæsthesia. For cases demanding even longer time he used up to 2 or 3 cc. of ethyl chloride. Working on these lines he had given 30,000 adminstrations of ethyl chloride or ethyl chloride and gas without fatality until recently, when he unfortunately had had a death in the Dental Department of the Royal Infirmary. The patient was sent to him for the extraction of fifteen very septic teeth; she was absolutely panic-struck; he began the anæsthesia by giving her 3 cc. of ethyl chloride by the vapour method; during the early part of the administration she screamed almost continuously; she finally, however, went under, the colour remaining good. One tooth was extracted when a slight amount of pallor and faintness of respiration was observed, the pupil remaining small, and he proceeded, therefore, to take out another tooth. The pallor then increased, and he therefore stopped operating and had her lowered to the floor and commenced artificial respiration. The surgeon on duty was sent for and opened the abdomen in order to give cardiac massage, but by this time the patient was dead and did not respond in any way to the treatment. The patient was known

to have suffered from rheumatic fever but her heart had been thoroughly examined by a physician before the anæsthetic, and was believed to be perfectly sound. Owing to difficulties with the relatives it was most unfortunately impossible to secure an autopsy. It was arguable that this death was mostly due to the delayed effects of fright, but since the occurrence he had resolved always to add 1 cc. of ether to any ethyl chloride which he gave. There could, of course, be no absolute proof that this added to the safety, seeing the infinitesimally small death-rate from ethyl chloride given in the doses that he advocated. He had used nasal gas and nasal gas and oxygen extensively, but found that the ordinary nasal inhaler interfered a good deal with the work of the dentist. He therefore preferred his own appliance, which he showed to the meeting, where the gas was led by tubes into each side of the nose, the anterior nares being plugged by his instrument around the entering tubes. In working with nasal methods he had found great advantages from the use of a large sponge pushed on to the dorsum of the tongue; even with single dose methods he used this sponge, believing that it prolonged the anæsthesia without producing any serious embarrassment of respiration. Small sponges as used by some dentists were dangerous; he had seen a case where a man swallowed two of them and as he was already suffering from slight chronic intestinal obstruction considerable anxiety was felt, but the sponges were ultimately passed safely. He emphasised the danger of anything but a straight sitting-up position for extraction of teeth. He had an extensive experience of intra-tracheal anæsthesia but even now he thought the best results were obtained in malignant diseases of the mouth by doing a preliminary tracheotomy and packing the upper orifice of the larynx.

Dr. Logan Turner said that he personally accepted the position that the anæsthetist as a specialist was entitled to choose the drug and method which should be used, but he pointed out that by the law it was the surgeon who was responsible if anything happened. Team work in the class of case under discussion was quite essential. The surgeon and anæsthetist must be accustomed to work together and must have mutual confidence in each other's skill. He was a warm advocate of ethyl chloride given by vapour method for tonsils and adenoids in children (having had over 17,000 cases at the Royal Infirmary with only one fatality in fifteen years), but not adults. He did not consider that by it sufficient relaxation of the muscles of the palate could be obtained to give the operation by the reverse guillotome a fair chance. As anæsthetists from Glasgow were present, he would be glad to know whether it was the case that Dr. Sime habitually performed the operation of enucleation of the tonsils by scissors and snare under ethyl chloride alone. He would also like to know whether bromide of ethyl was still used in Glasgow by Dr. Kelly. Even for ethyl chloride he considered full preparation as for

a major anæsthetic was essential. He had noticed reference in American literature to abscess of the lung following operations for tonsils and adenoids, which might be ascribed either to dropping a piece of tissue down the larynx or perhaps merely to the expression of septic fluids from the tonsil at the moment of removal. He personally had never experienced this sequel, but would be glad to know whether any of the members of the Society had heard of such cases.

The PRESIDENT informed Dr. Logan Turner that he knew that Dr. Kelly did still habitually use ethyl bromide given from a handkerchief; the patient sat up and the head was thrown forward at intervals during the operation to get rid of the blood. So far as he knew no other throat surgeon used the method.

As regards the point between heroin and morphia, he did think heroin produced less after-effects. He had had, however, very good results with "Abbott's H.M.C." preparation of morphia and desired to know whether other members considered this preparation had any special advantages. He had entirely abandoned the old Junker and used the Shipway instrument instead, using mostly pure ether, and in this particular class of case delivering the stream through a No. 10 catheter along the nose into the pharynx. He often used oxygen with the apparatus instead of air. He thought, however, that intra-pharyngeal anæsthesia by this method was inadequate in many cases as compared with true intra-tracheal, as one missed the return flow of air. He had no special fear of carrying malignant disease into the lung by the catheter unless the ulcer was very foul, and thought the gain was tremendous over a tracheotomy opening. He agreed that ethyl chloride was inadequate for tonsils and adenoids in adults, using open ether followed if necessary by the Shipway, by nasal tube. For longer dental cases his own practice differed evidently from that in use in Edinburgh, as he made extensive use of nasal gas with air. He admitted that the counsel of perfection was to give it with oxygen, but the question of the weight of the cylinders made nasal gas and oxygen hardly practical politics. He found no difficulty in fitting almost any size or shape of nose with this appliance and did not find that it interfered materially with the work of the surgeon. His apparatus provided for beginning the administration both by the nose and mouth, but anæsthesia was prolonged by the nose alone with considerable plus pressure. He commonly continued it for fifteen minutes, and by the use of an air valve on nose-piece had no difficulty in avoiding serious cyanosis. Admittedly certain cases could not be handled by nasal gas, and he always had a Clover ready. For children under 12, even for dental cases, he found gas, certainly nasal gas, unsuitable, and preferred to rely upon ethyl chloride alone. He regarded 3 cc. as the outside dose for a child and with it had only had one serious fright; the child, however, recovered. If 3 cc. of ethyl chloride was insufficient he preferred to use closed ether.

Dr. J. S. Ross referred to O'Malley's technique for nasal operations, particularly for sub-mucous resection of the septum. Its essentials were the tilting of the head table to an angle of 45°, a pillow placed behind head and neck just down to the upper portion of the shoulders producing a slight flexion of the neck; the use of Phillip's artificial air-way to produce strict oral respiration and a combination of local anæsthesia by packing the nose beforehand and continuing with a very light chloroform anæsthesia. Having worked with O'Malley for a short period during the war he had been struck with the smoothness of events if every one of these details was strictly adhered to. Another point in O'Malley's method was the use of a very deep nitrous oxide anæsthesia for the enucleation of tonsils and adenoids, even in young, strong adults. With regard to dental work he adhered to the method devised by Dr. Guy and himself, which was only an elaboration of the original gas oxygen method devised by Guy. He agreed with Dr. Gibbs that in using any of these methods it was better to produce a deep anæsthesia with gas or gas and oxygen in the first instance, and to use a small dose of ethyl chloride in the last few seconds of the anæsthesia only. He was inclined to think that Guy's original instructions for the anæsthesia were slightly defective in that not enough advantage was taken of the nitrous oxide element before adding the ethyl chloride. None the less, the credit for pointing out the advantages of the combination of nitrous oxide with a very small dose of ethyl chloride as against the method of giving large doses of ethyl chloride alone for dental purposes was certainly due to Guy. With regard to nasal methods, the addition of oxygen enormously simplified the actual administration, but the question of the bulk and weight of the apparatus was so important that he had been specially interested in listening to Dr. Fairlie's experience of nasal gas without special provision for oxygen.

Dr. Frew had himself removed a good many tonsils and adenoids under Kelly's bromide of ethyl method and found it most successful. With regard to septic lung trouble after operation, he had had two personal experiences; one was a lung abscess following the extraction of very septic teeth—no solid foreign body was ever detected in the lung and the patient eventually recovered. In another case septic trouble followed a piece of bone inhaled during an operation upon the antrum; lung abscess followed, the bone was ultimately coughed up, and here also complete recovery followed.

Dr. Napier, in reply to Dr. Logan Turner's question, said it was the case that Dr. Sime did enucleate tonsils by scissors and snare under a single dose of ethyl chloride.

Dr. Barras considered that the Shipway apparatus overcame most of the difficulties of nose and mouth operations which could not be covered by single dose anæsthetics. With regard to ethyl chloride he used it extensively among children and did not consider that there was in its use any very material after-sickness.

Dr. TORRANCE THOMSON alluded to the impossibility of proving that the addition of ether increased the safety of ethyl chloride; how could you prove it if you had to wait for 30,000 cases before you got your first death after ethyl chloride alone? The further question arose, however, of whether it improved the anæsthesia in type and duration. There is a belief among some people that it does. With regard to tonsils and adenoids in adults he described Rood's method of saturating the patient with ether given from the open mask much overlaid with towels and blankets. In Rood's own hands the results seemed to be excellent. He asked whether Dr. Ross could tell him anything of the posture used by the late Professor Alexis Thomson in certain neck operations.

Dr. ROSS said that Professor Thomson used habitually to do all his tongue and neck operations with the patient pulled into a position almost fully sitting up with the neck very much extended. Ether (preferably intra-tracheal) was always used, and the results were excellent, particularly in neck dissections, as the veins were never engorged.

Dr. LOGAN TURNER said he desired to ask two questions before Dr. Gibbs replied: firstly, with regard to O'Malley's method, did Dr. Gibbs consider that adrenalin, used before operation, might be a source of danger when chloroform was given later, and secondly, was it not the case that with intra-tracheal anæsthesia the surgeon was often very much troubled by the return blast of air and ether playing in his face?

Dr. GIBBS replied generally to the discussion. He was of opinion that chloroform should not be given after adrenalin. He considered that the surgeon was bound to get a certain amount of anæsthetic and did not see why the intra-tracheal method should be specially objectionable in that respect. With regard to the sickness after ethyl chloride, he believed that there was a good deal but that it often came on later when the patient had left the dentist's house. Even apart from sickness there was undoubtedly a good deal of malaise and feeling of depression. He therefore gave the smallest dose possible. He desired to emphasise the fact that when in his opening remarks he referred to the Junker he really meant the Shipway.

At the close of the meeting Dr. TORRANCE THOMSON demonstrated the Pinson Bomb and the intra-tracheal apparatus devised for use with it. He also showed Mr. Dott's intra-tracheal apparatus.

J. S. ROSS, *Acting Hon. Secretary.*

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BIBLIOGRAPHY OF CURRENT ANÆSTHETIC LITERATURE.

Anæsthesia, General, Bronchoscopic Observations on Cough Reflex in Tonsillectomy done under. M. C. Myerson. *Laryngoscope,* St. Louis, Jan., 1924.

Anæsthesia, Paravertebral, Kidney Operations under. Oswald Swinney Lowsley and Winfield Scott Pugh. *Journ. Am. Med. Assn.,* March 29, 1924.

Anæsthesia, Local, in Handling Septic Conditions within Abdomen. R. E. Farr. *Amer. Jl. of Obstetrics and Gynæcology,* St. Louis, Feb., 1924.

Anæsthesia, Spinal. A. G. Rytina and H. L. Tolson. *Annals of Surgery,* Philadelphia, Feb., 1924.

Anæsthesia, Responsibility in Death During. K. Frehse. *Deutche medizinische Wochenschrift,* Leipzig, Feb. 22, 1924.

Anæsthetics, A Surgeon's Thoughts on Anæsthetics. *Proceedings of the Royal Society of Medicine,* May, 1924.

Anæsthesia Question, the General. P. Balkhausen. *Deutsche Zeitschrift für Chirurgie,* Leipzig, Jan., 1924.

Anæsthesia of Splanchnic Nerve in Abdominal Operations. H. Fischer. *Annals of Surgery,* Philadelphia, March, 1924.

Butyn as Local Anæsthetic. St. C. Thomson. *British Medical Journ.* Feb. 9, 1924.

Blocking the Splanchnic Nerve. K. Bachlechner. *Zentralblatt für Chirurgie,* Leipzig, Feb. 2, 1924.

Cocaine Substitutes, the Comparative Value of. R. Foster Moore. *British Journal of Ophthalmology.* March, 1924.

Cocaine, Surface Anæsthesia with. V. Gehse. *Deutsche medizinische Wochenschrift, Leipzig.,* Feb. 15, 1924.

Ethylene Anæsthesia in Genito-Urinary Surgery. Arno B. Luckhardt and Herman L. Kretschmer. *Journal of Urology,* Baltimore, April, 1924.

Ethylene and Nitrous Oxide Anæsthesia, Blood Reaction in. Chauncey D. Leake and Alrick B. Hertzman. *Jl. Am. Med. Assn.,* Apr. 12, 1924.

Ethylene-Oxygen Anæsthesia. J. S. Horsley, Jr. *Virginia Medical Monthly,* Richmond, March, 1924.

Hæmorrhoids under Regional Anæsthesia. S. H. Graves. *Virginia Med. Monthly,* Richmond, March, 1924.

Heart Lesions from Anæsthetics. H. Strube. *Zeitschrift für Geburts. und Gynäk.,* Stuttgart, Feb. 9, 1924.

Local Anæsthesia, Poisoning from, of Mucous Membranes. H. Wieland. *Deutsche medizinische Wochenschrift,* Leiepzig, Feb. 22, 1924.

Local Anæsthesia. M. Kappis. *Medizinische Klinik*, Berlin, Feb. 24, 1924.

Local Anæsthesia Applied to the Hand. G. Klinger. *Zentralblatt für Chirurgie*, Leipzig, Feb. 2, 1924.

Local Anæsthesia with Potassium Bromide. J. P. Dmitrijew. *Zentralblatt für Chirurgie*, Leipzig, Feb. 2, 1924.

Local Anæsthesia in Urologic Surgery. A. O. Singleton. *Texas State Journal of Medicine*, Fort Worth, Feb., 1924.

Local Anæsthesia. H. S. Collisi. *Michigan State Med. Society Journ.*, Grand Rapids, March, 1924.

Novocain Anæsthesia. G. F. Cottle. *U.S. Naval Medical Bulletin*, Washington, D.C., Feb., 1924.

Sacral Nerve Block Anæsthesia in Surgery of the Prostate Gland and Bladder, the Value of. E. Starr Judd and William R. Meeker. *Journal of Urology*, Baltimore, April, 1924.

Serum Therapy of Experimental Botulism, The Effect of Anæsthesia and of Sedatives on the. Jacques J. Bronfenbrenner and Harry Weiss. *Journal of Experimental Medicine*, Baltimore, April 1, 1924.

Splanchnic Nerve in Abdominal Operations, Anæsthesia of the. Hermann Fischer. *Annals of Surgery*, Philadelphia, March, 1924.

Spinal Anæsthesia. Anton G. Rytina and Howard L. Tolson. *Annals of Surgery*, Philadelphia, Feb., 1924.

Tropacocaine, A Critical Report on One Hundred Cases of Spinal Analgesia with. Henry Featherstone. *Proceedings of the Royal Society of Medicine*, March, 1924.

The First Annual Meeting of the Board of the "British Journal of Anæsthesia" was held at the Royal Society of Medicine, Wimpole Street, London, on June 11th, 1924. The balance sheet was found to be satisfactory, and it was agreed that the first year of the Journal has proved highly satisfactory and encouraging in every particular. The support received from subscribers and advertisers warranted the conclusion that the success of the venture justified the optimism of all those who from the first so encouragingly supported the idea of establishing the "British Journal of Anæsthesia." It was definitely decided to devote all profits to bettering the Journal and advancing the interests of Anæsthesia.

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